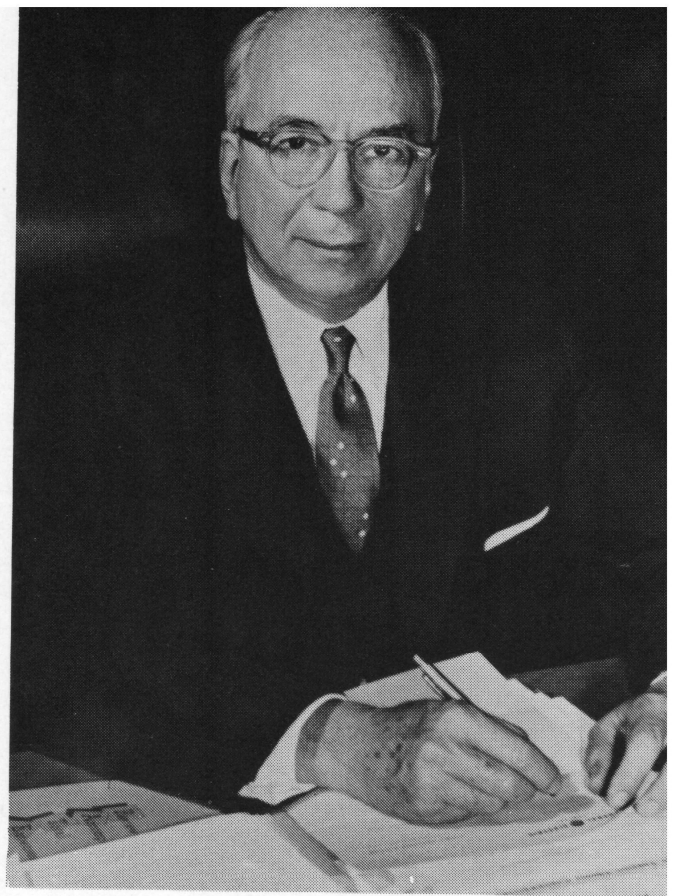
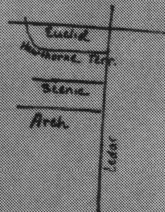
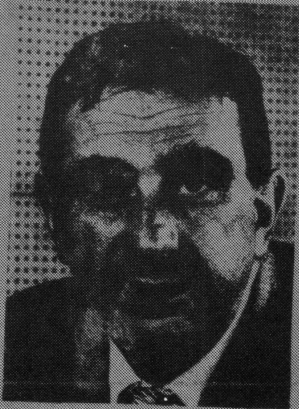


Rear Admiral Lewis L. Strauss, Teller's close personal friend and political ally. Strauss was chairman of the AEC during the Oppenheimer hearing. This portrait was taken in 1959, when Strauss was Eisenhower's Secretary of Commerce designate, just before an embittered U.S. Senate refused to confirm his appointment.



## EDWARD TELLER. WAR CRIMINAL

- Worked on atomic bomb during WW2
- Father of Hydrogen bomb
- Largely responsible for establishment of the Livermore Rad Lab
- Leading advocate of arms race
- Leading advocate of nuclear blackmail
- Has acted as hawk advisor to Washington officials, including Nixon, since WW2



He is living in our community:  
1573 Hawthorne Terrace  
840-8871

People in the community have a responsibility to challenge Teller on his activities. You can do this by giving him a call or going by to discuss them with him.

**CAN YOU DIG IT?**

Circular distributed by Berkeley radicals prior to the "trial" of Edward Teller by a "war crimes tribunal" on November 23, 1970. The "trial" ended with a mob marching toward Teller's house, some of them threatening to burn it down.

Dr. John A. Wheeler, the celebrated Princeton physicist who was the first American to learn that German scientists had split a uranium nucleus, paving the way for the nuclear age. Wheeler has for many years been a colleague and defender of Teller.

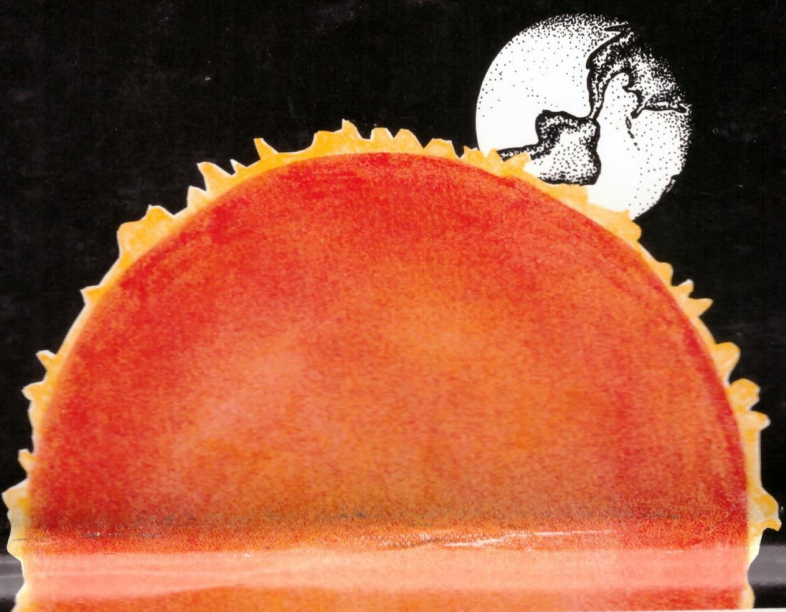




ENERGY & CONFLICT

# The Life and Times of EDWARD TELLER

by Stanley A. Blumberg and Gwinn Owens



## ENERGY & CONFLICT The Life and Times of EDWARD TELLER by Stanley A. Blumberg and Gwinn Owens

"They manage to make the complex issues consistently interesting reading."  
—*Publishers Weekly*

Here is the first biography of Edward Teller, based on exclusive access to the man and the archives. This is the life story of perhaps the most controversial and certainly one of the greatest nuclear physicists of the twentieth century. Widely known as the father of the hydrogen bomb, Teller is a genius among giants in the scientific community, his career coterminous with the nuclear age. His controversy with Robert Oppenheimer, here updated, constitutes, of course, one of the dramatic high points of the Cold War, in which Teller has been an absolutely crucial figure.

Messrs. Blumberg and Owens, with political leanings often different from Teller's, have written an objective book. Indeed, Teller's full cooperation was conditional on their objectivity. This included the release of his correspondence and his arranging for the declassification of key papers by the former Atomic Energy Commission.

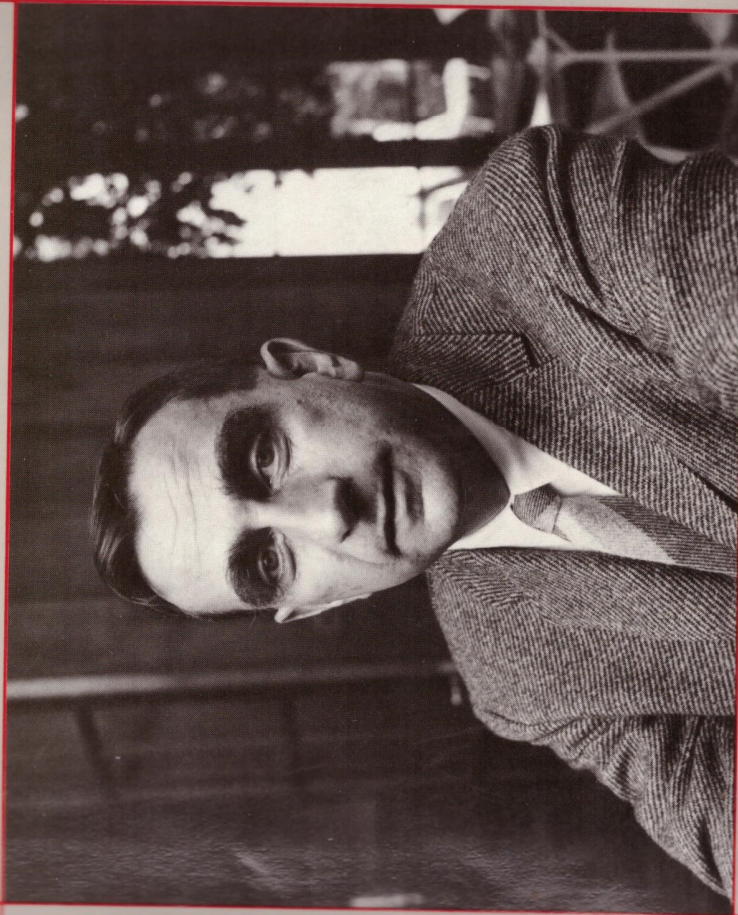
A major revelation among many first-time disclosures is the fact that, contrary to pre-

(Continued on back flap)



# Edward Teller

GIANT OF THE GOLDEN  
AGE OF PHYSICS



STANLEY A. BLUMBERG

> \$24.95  
\$34.95 IN CANADA

Crucial reading for an understanding of the nuclear age, Blumberg and Panos's life of Edward Teller is definitive for our time. Authoritative but never "authorized," it is an intimate, objective account based not only on extended, exclusive access to Teller, but also on exhaustive research among his colleagues and critics.

Teller's long life is coterminous with the epochal history of this century, and the authors bring into focus Teller's scientific contributions against a backdrop of monumental events in the world at large. Among their revelations is confirming evidence of how the USSR beat the United States in firing the first thermonuclear device and operating the first deliverable hydrogen bomb. The authors also reveal the stunning fact that the Joint Chiefs of Staff once pressed President Eisenhower to launch a "preventive war" against the Soviet Union on evidence of the Russians' H-bomb research. Teller himself has often been a shaping figure in this history, in the development of fusion power, of the atomic bomb and the hydrogen bomb, of the Strategic Defense Initiative ("Star Wars"), and of the missile defenses of Israel.

*Edward Teller* addresses the traumatic Oppenheimer affair and tells of Teller's ostracism and his bitter political controversies, but the book delineates, as well, his genius as a scientist and his profound devotion to democracy and to totally free exchange of scientific findings. Whatever his flaws, Teller emerges as a prodigious achiever, and this biography is a vivid refutation of the media distortion of him as a "Dr. Strangelove," showing him to be a good



"It's a remarkable book, a full and fair account of Teller the scientist, Teller the politician, Teller the aggressor, Teller the vulnerable."

—Mike Wallace, Correspondent, CBS News/*Sixty Minutes*

"For those of us who never hoped to understand just why it is that  $E$  is equal to  $mc^2$ , this biography of a great physicist is important primarily because we come to know a great man. His contributions as a statesman are the equal of his contributions as a scientist. Messrs. Blumberg and Panos have met the extraordinary challenge of portraying this complicated, delicate, determined idealist."

—William F. Buckley

"Teller's lifetime passion for both peace and freedom is linked to his understanding that the greatest threat to both comes from weakness, not from strength. Only a mind as brilliant as Teller's could have connected the fields of physics and politics, first by helping to create nuclear deterrents and then by proposing strategic defenses against those, once freedom's enemies acquired them."

—Jack Kemp

"Edward Teller is a great scientist who has always had a commitment to the defense of his adopted country and of the free world.... Few scientists in this century have had such an impact.... Those who know him admire him as a warm human being, always ready to help a friend, a student, or a good cause."

—Yuval Ne'eman,  
Chairman, Israel Space Agency

"A thoughtful perspective on the life and times of Edward Teller."

—Henry Kissinger

**SALE**

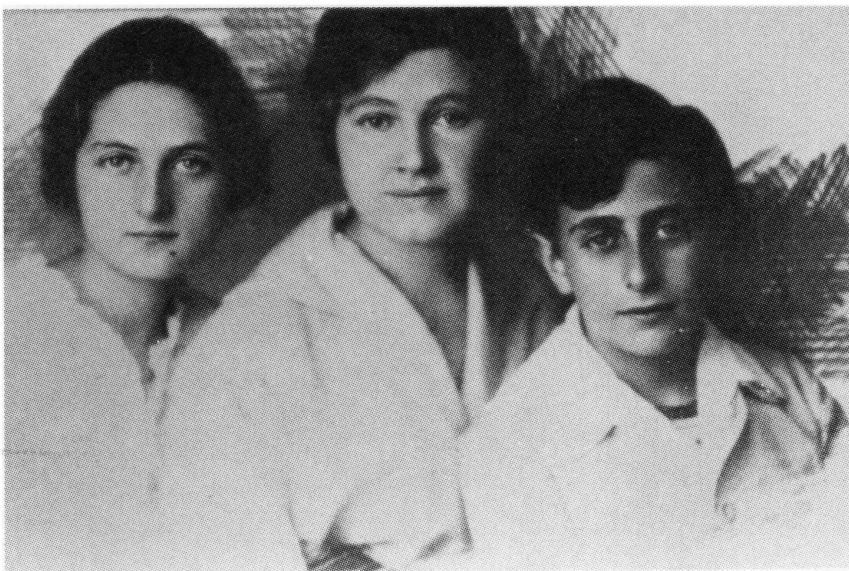
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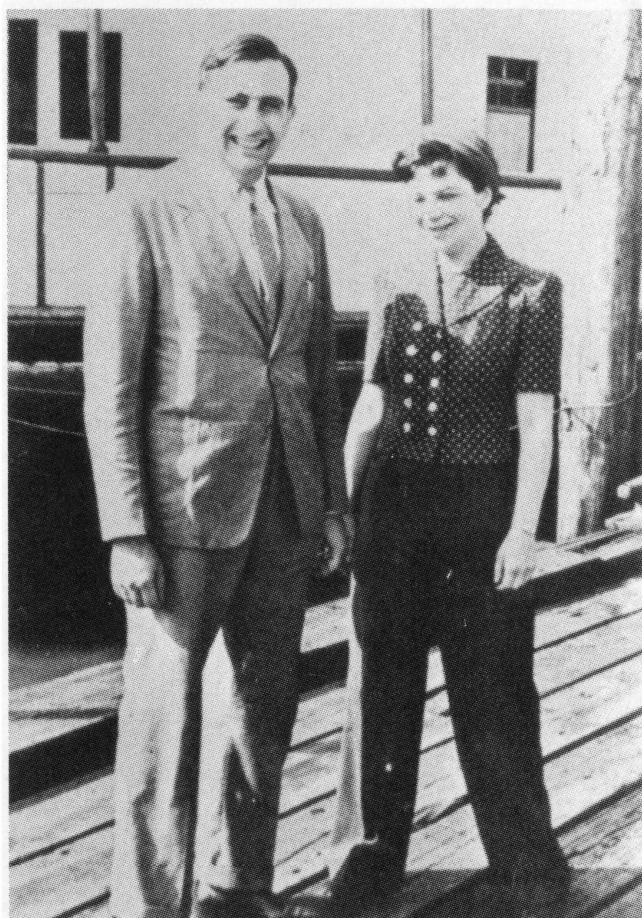




Preteen Edward Teller with his sister, Emmi (*left*), and mother. *Teller Family Archive.*

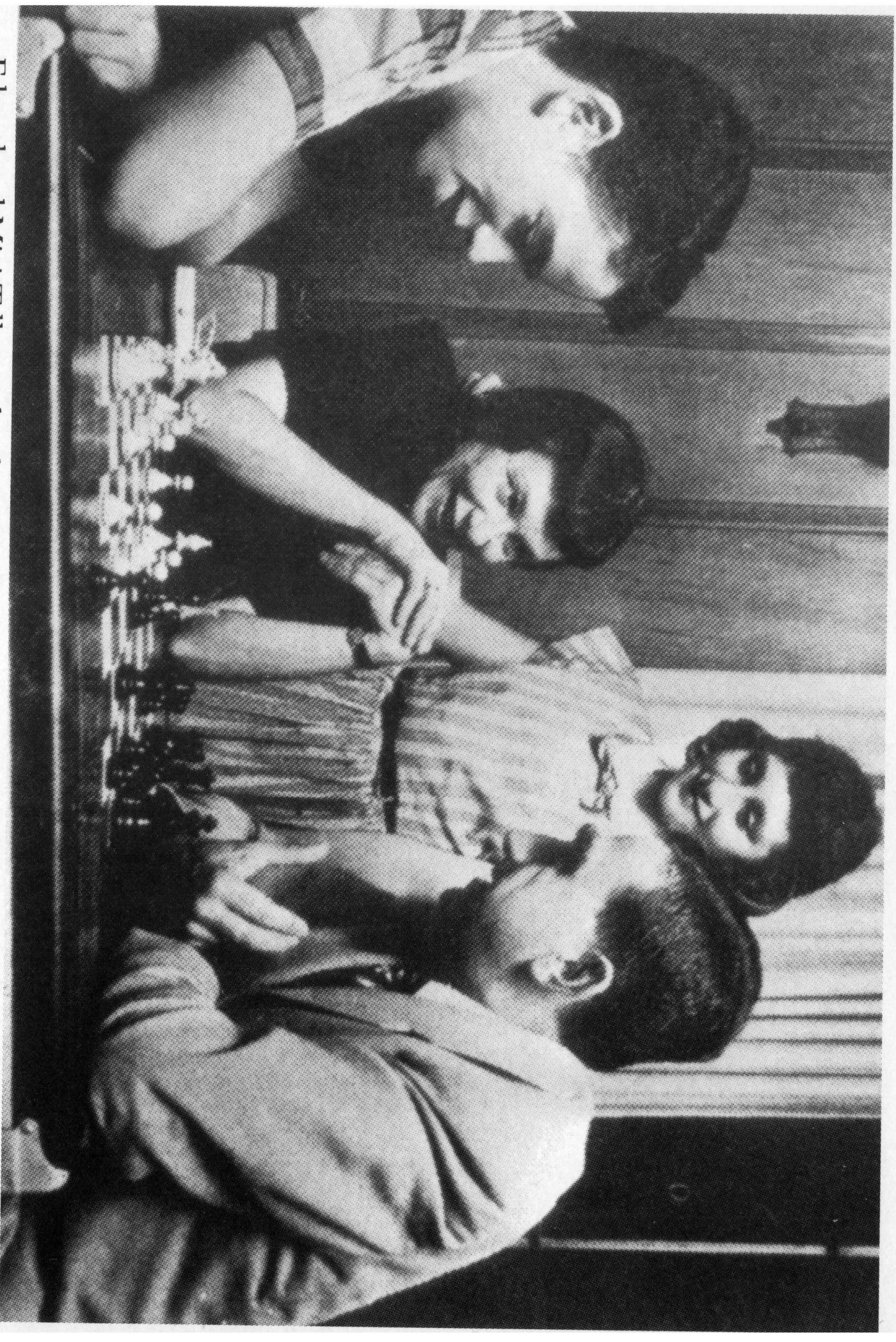


Nineteen-year-old Edward Teller as a student in Germany. *Teller Family Archive.*



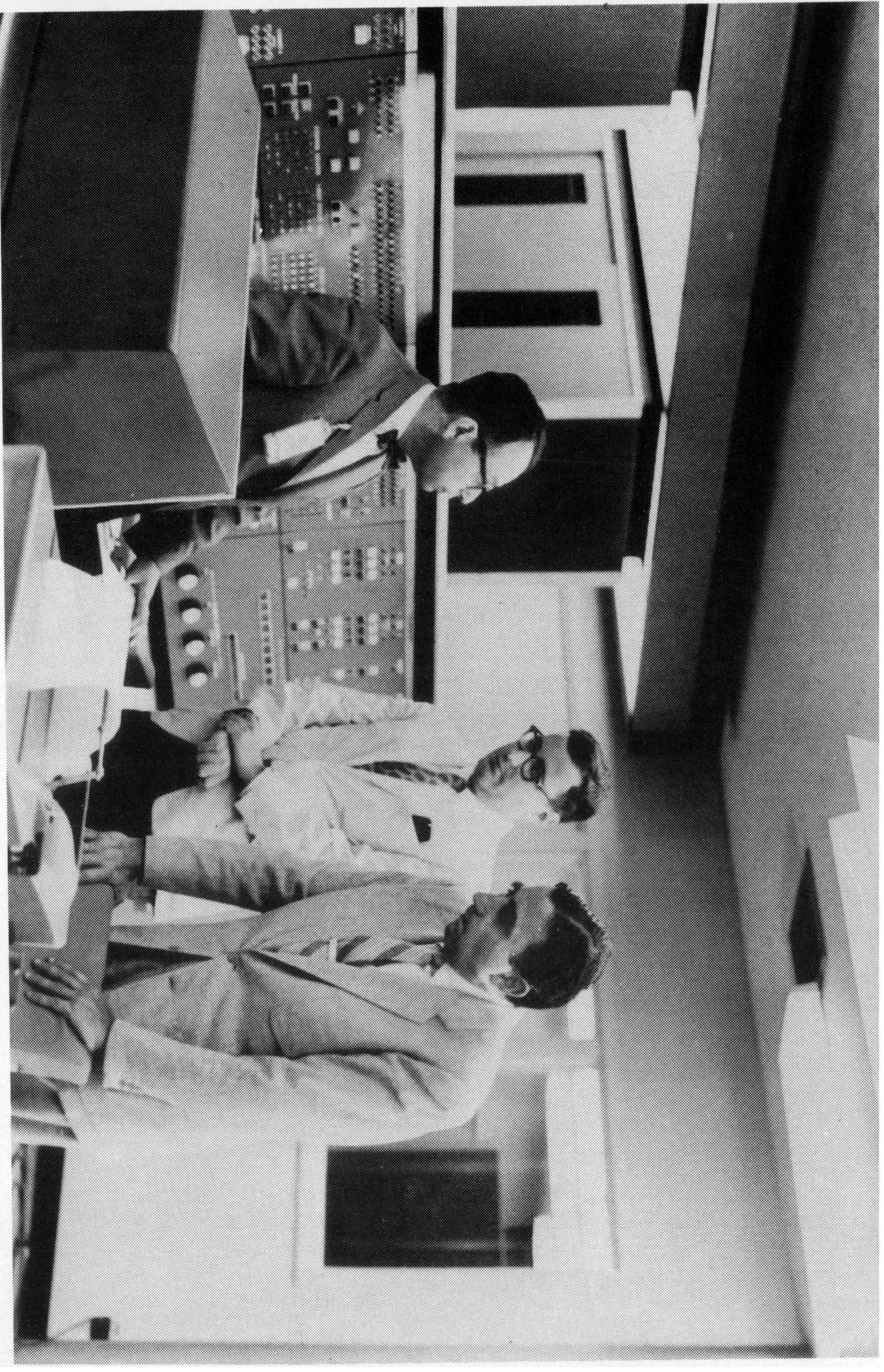
Edward Teller and his wife, Mici, shortly before he joined the Atomic Bomb Project at Los Alamos. *Teller Family Archive.*





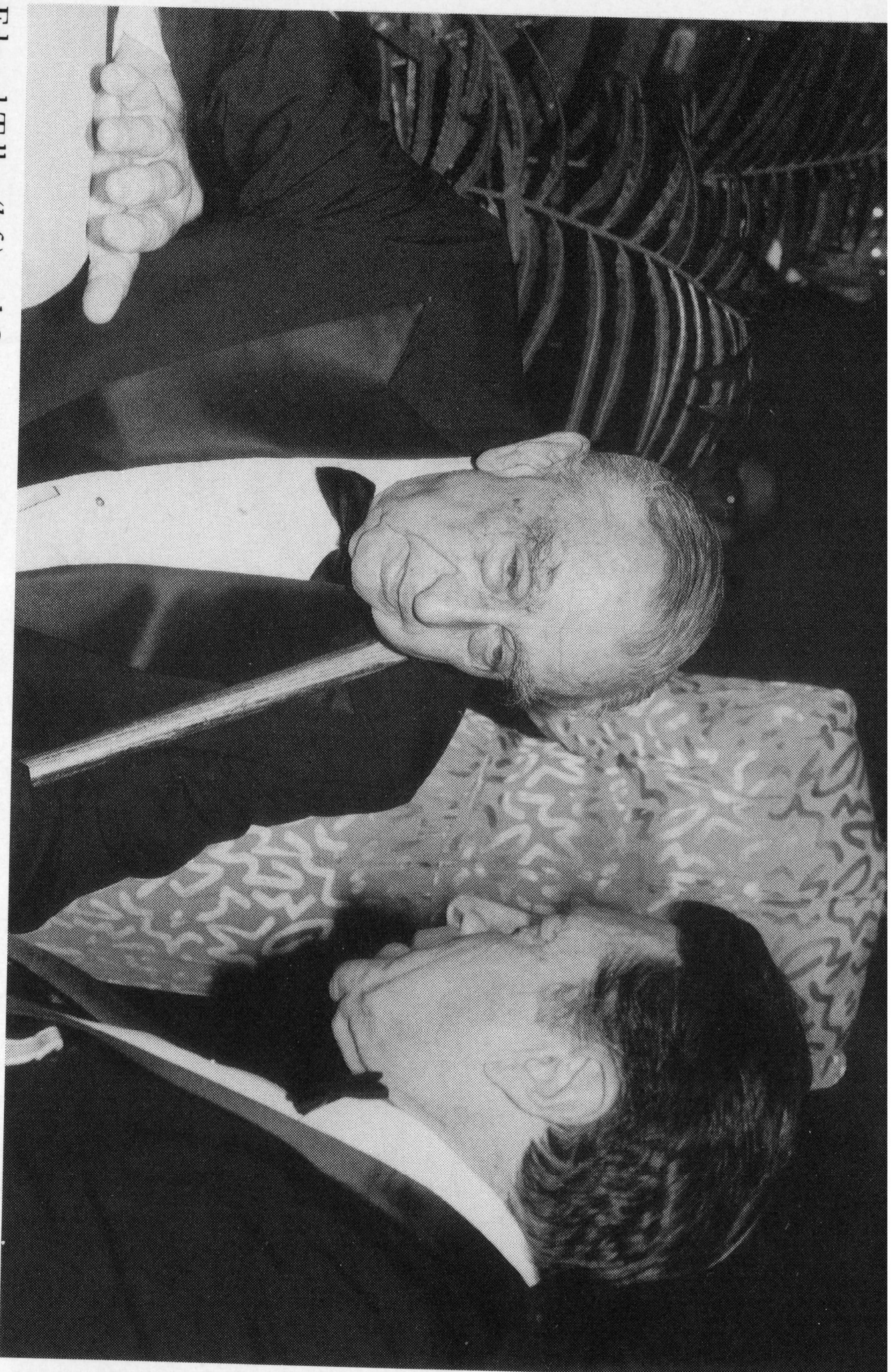
Edward and Mici Teller at chessboard with son, Paul, as daughter, Wendy, looks on. *Teller Family Archive.*





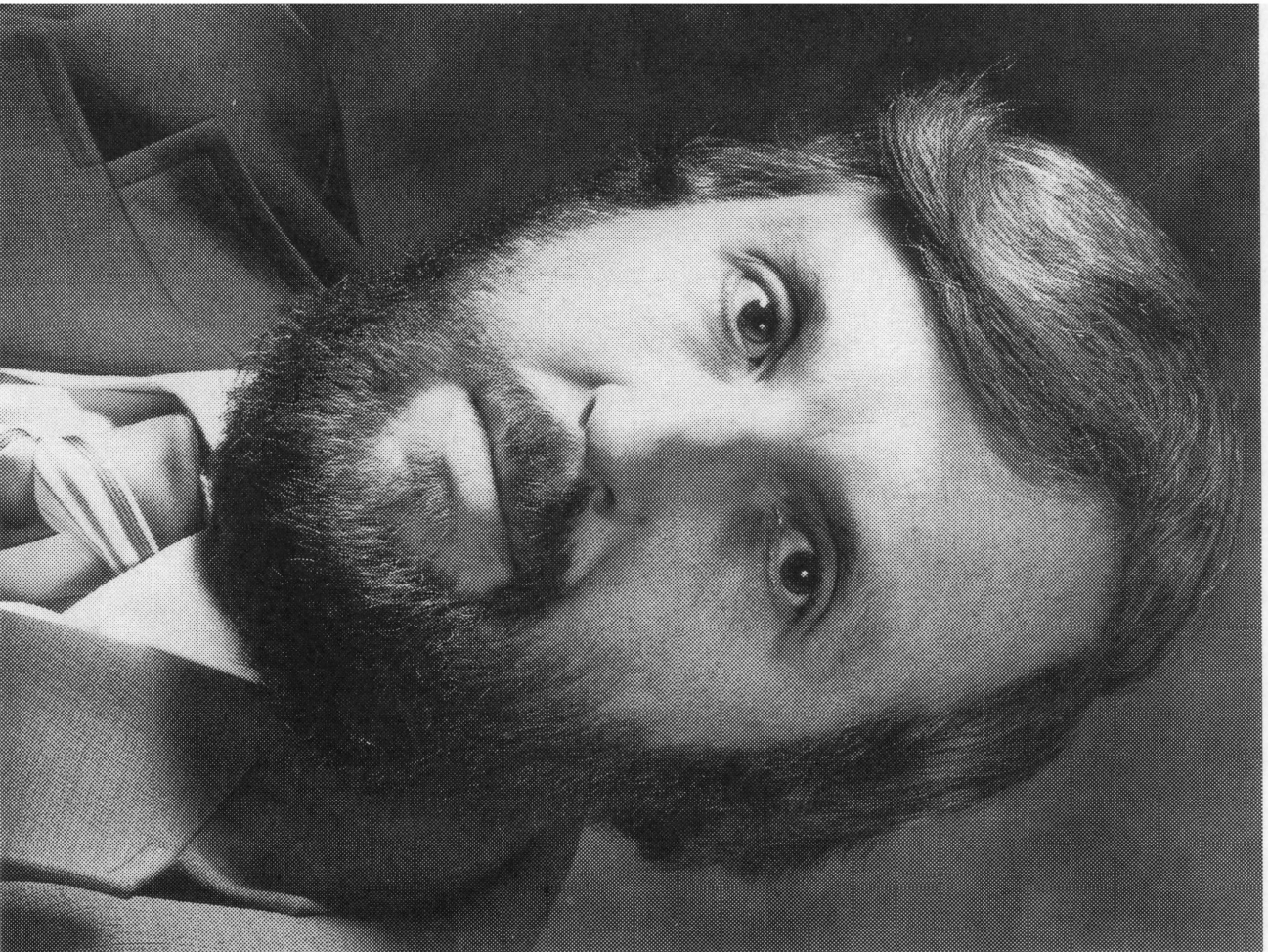
Edward Teller (*right*) with Harold Brown (*center*), director of Lawrence Livermore National Laboratory in 1960, and Sidney Fernback, head of Computation Division at Lawrence Radiation Laboratory. U.S. Department of Energy.



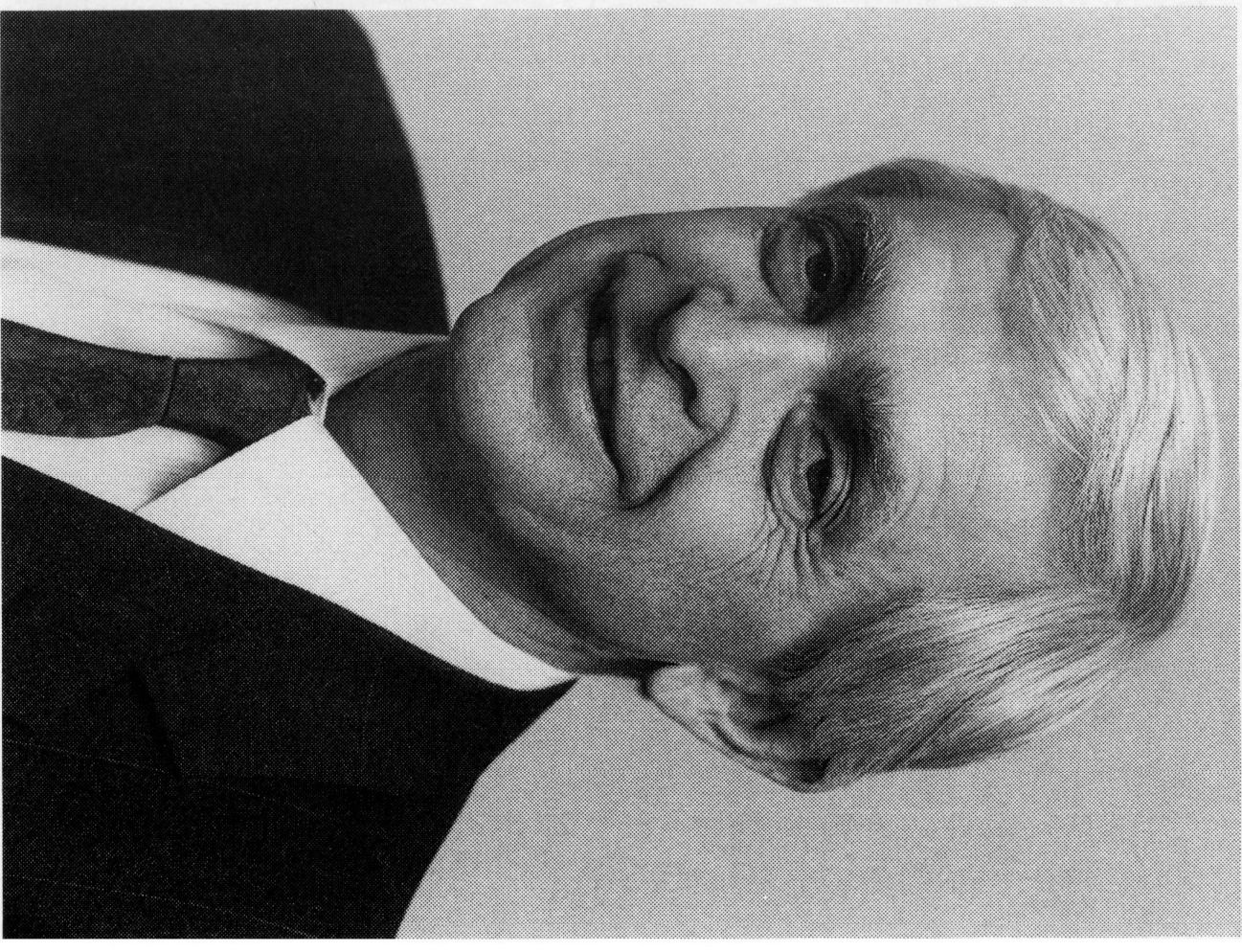


Edward Teller (*left*) and Caspar Weinberger, former secretary of defense, confer during reception preceding the dinner in Washington, D.C., on November 16, 1988, at which Teller and Andrei Sakharov, Nobel Prize-winning Soviet physicist and human rights champion, met for the first time. © C. Kane.



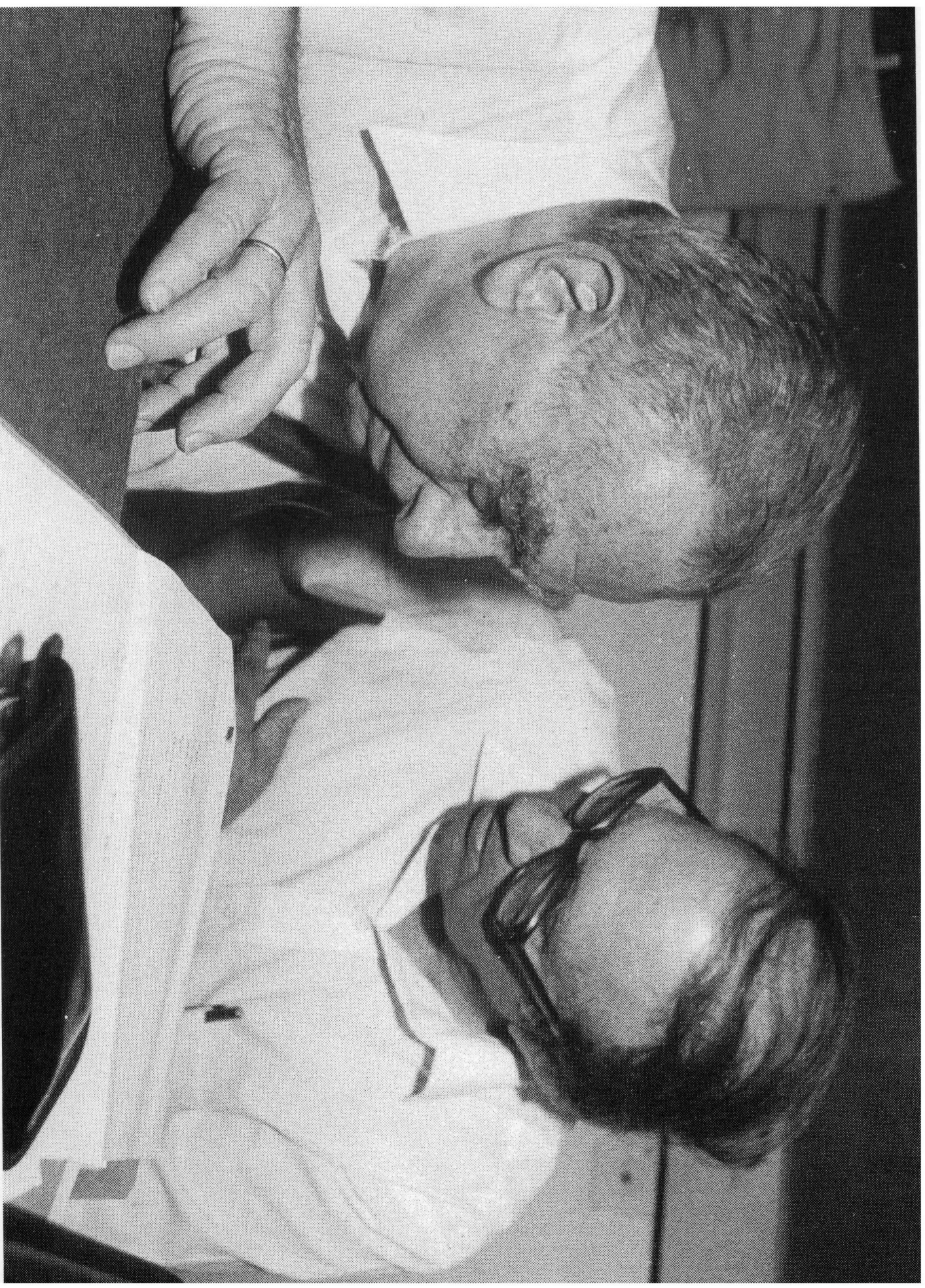


Lowell Wood, chief aide to Edward Teller and top recruiter of young scientists for nuclear weapons programs at Livermore. *Lawrence Livermore National Laboratory.*



John Nuckolls, director of Lawrence Livermore National Laboratory as of May 11, 1988 (appointed 1987). *Lawrence Livermore National Laboratory.*





Edward Teller (*left*) and Yuval Ne'eman, Israeli physicist and government leader, confer in 1985 during one of Teller's frequent visits to the Middle East. *Isaac Freidin.*

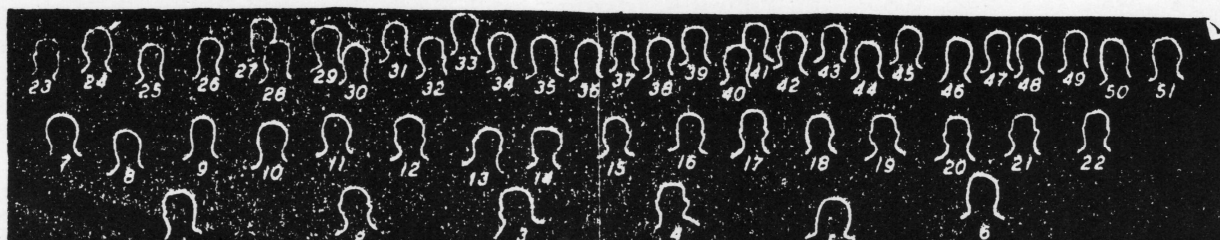




These were the participants in the fifth Washington Conference on Theoretical Physics, thrown into a turmoil when Niels Bohr (first row, fourth from left) interrupted the proceedings to announce that a month earlier, in Germany, the chemists Hahn and Strassman had split a uranium nucleus. The world was never the same again.

- 1 - Stern, Carnegie Tech, Pittsburgh
- 2 - Fermi, Rome, Columbia
- 3 - Fleming, Carnegie Institution of Washington
- 4 - Bohr, Copenhagen, Princeton
- 5 - London, Duke, Paris
- 6 - Urey, Columbia
- 7 - Brickwedde, National Bureau of Standards
- 8 - Breit, Wisconsin, Carnegie Institution
- 9 - Silsbee, National Bureau of Standards
- 10 - Rabi, Columbia
- 11 - Uhlenbeck, Columbia
- 12 - Gamow, George Washington
- 13 - Teller, George Washington
- 14 - Mrs. Mayer, Johns Hopkins
- 15 - Bitter, Massachusetts Institute of Technology
- 16 - Bethe, Cornell
- 17 - Grayson-Smith, Toronto
- 18 - Van Vleck, Harvard
- 19 - Jacobs, Massachusetts Institute of Technology
- 20 - Starr, Massachusetts Institute of Technology
- 21 - Hebb, Duke
- 22 - Squire, Pennsylvania
- 23 - Kuper, U.S. Public Health Service
- 24 - Mahan, Georgetown
- 25 - Myers, Maryland

- 26 - Roberts, Carnegie Institution of Washington
- 27 - Critchfield, George Washington
- 28 - Baroff, U. S. Patent Office
- 29 - Bohr, Jr., Copenhagen
- 30 - Meyer, Carnegie Institution of Washington
- 31 - Herzfeld, Catholic University
- 32 - Lord, Johns Hopkins
- 33 - Inglis, Johns Hopkins
- 34 - Wulf, U. S. Department of Agriculture
- 35 - Wang, Peking, Carnegie Institution of Washington
- 36 - Johnson, Carnegie Institution of Washington
- 37 - Mohler, National Bureau of Standards
- 38 - Scott, National Bureau of Standards
- 39 - Vestine, Carnegie Institution of Washington
- 40 - Rosenfeld, Liege, Copenhagen, Princeton
- 41 - Seitz, Pennsylvania
- 42 - Diecke, Johns Hopkins
- 43 - Mayer, Johns Hopkins
- 44 - Hibben, Carnegie Institution of Washington
- 45 - Tuve, Carnegie Institution of Washington
- 46 - O'Bryan, Georgetown
- 47 - Hafstad, Carnegie Institution of Washington
- 48 - Cohen, Columbia
- 49 - Hoge, National Bureau of Standards
- 50 - Sklar, Catholic University
- 51 - Rossini, National Bureau

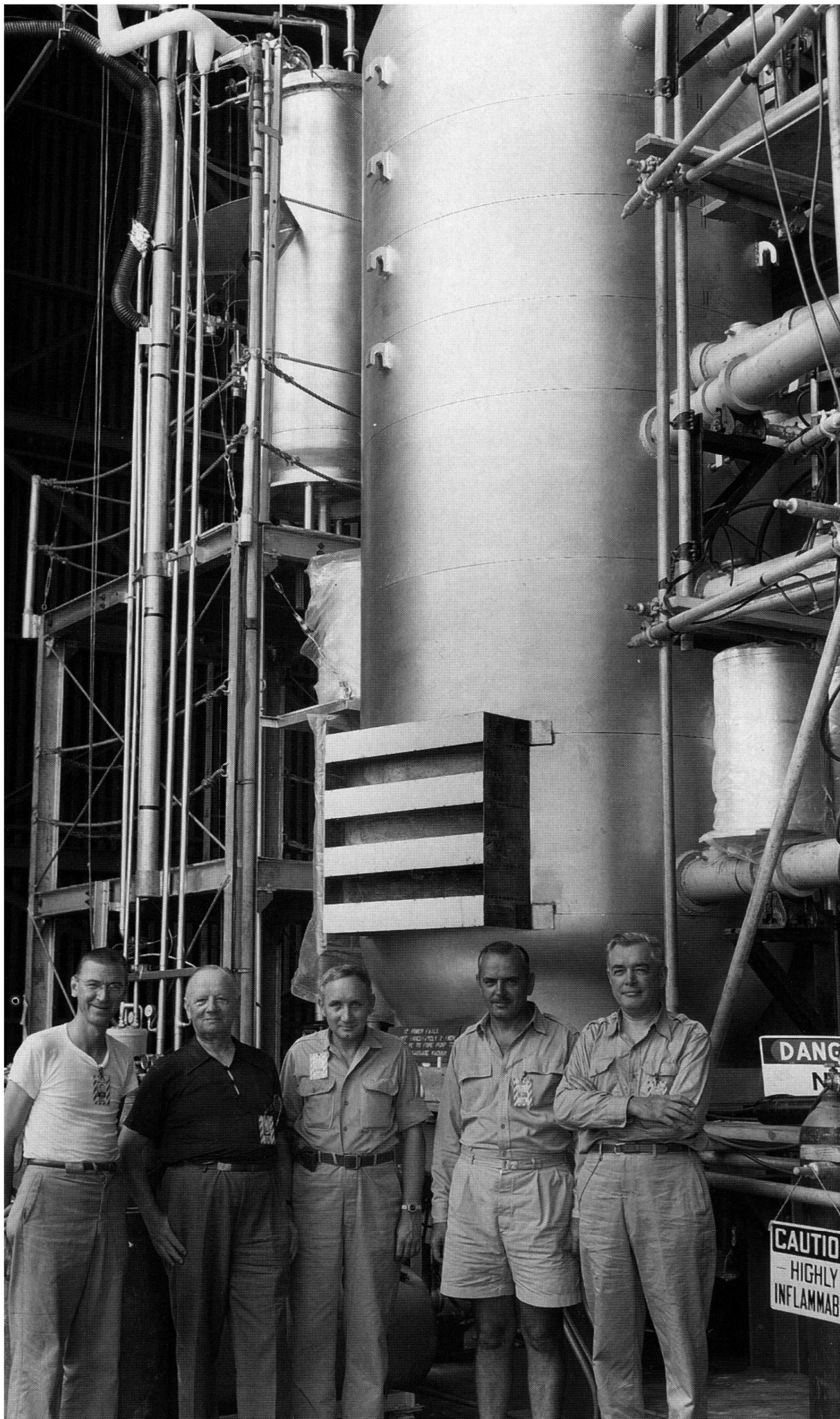




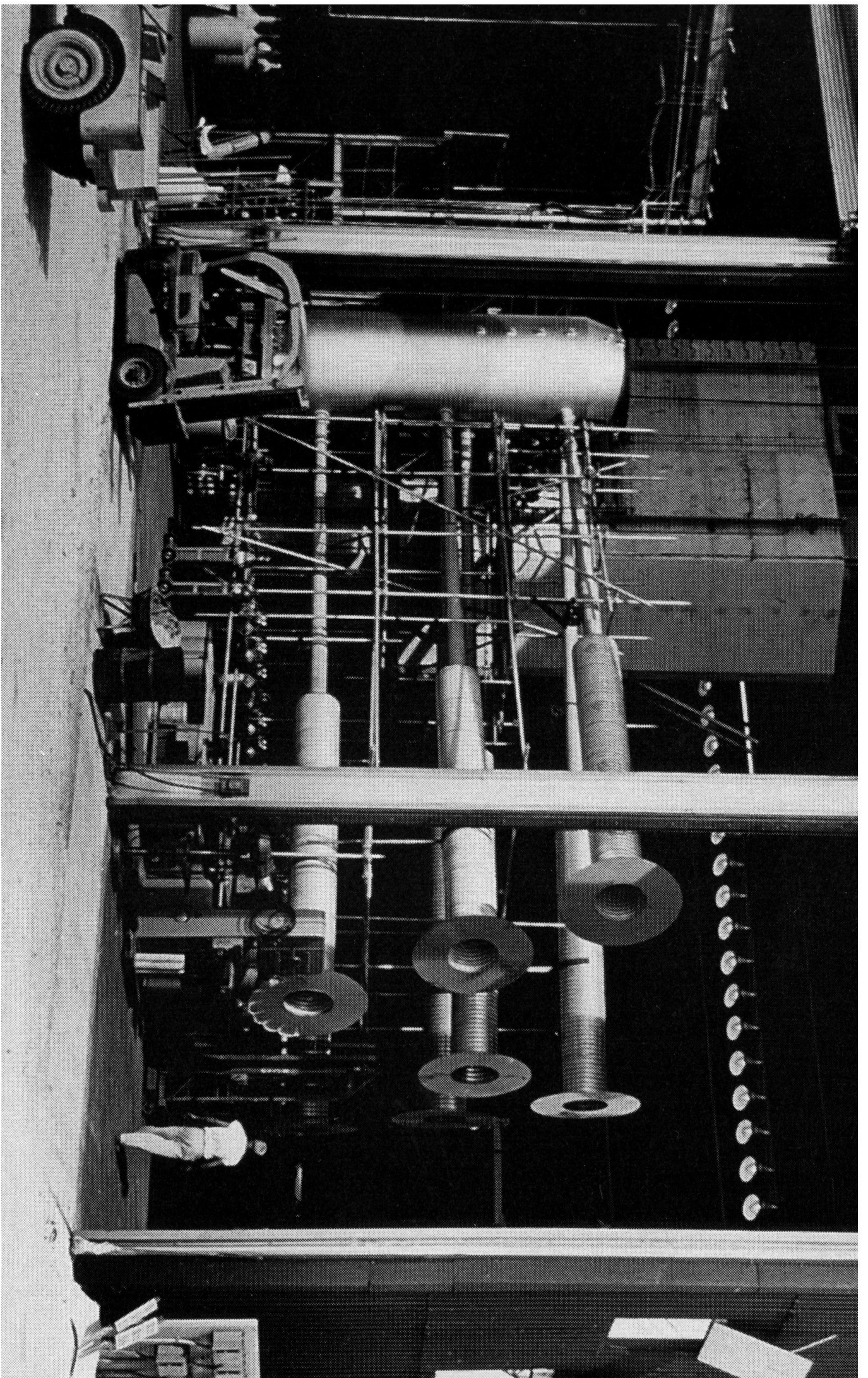


9000 ft. KRAUSE - OGLE Y-RAY BOX, MIKE TEST 1332

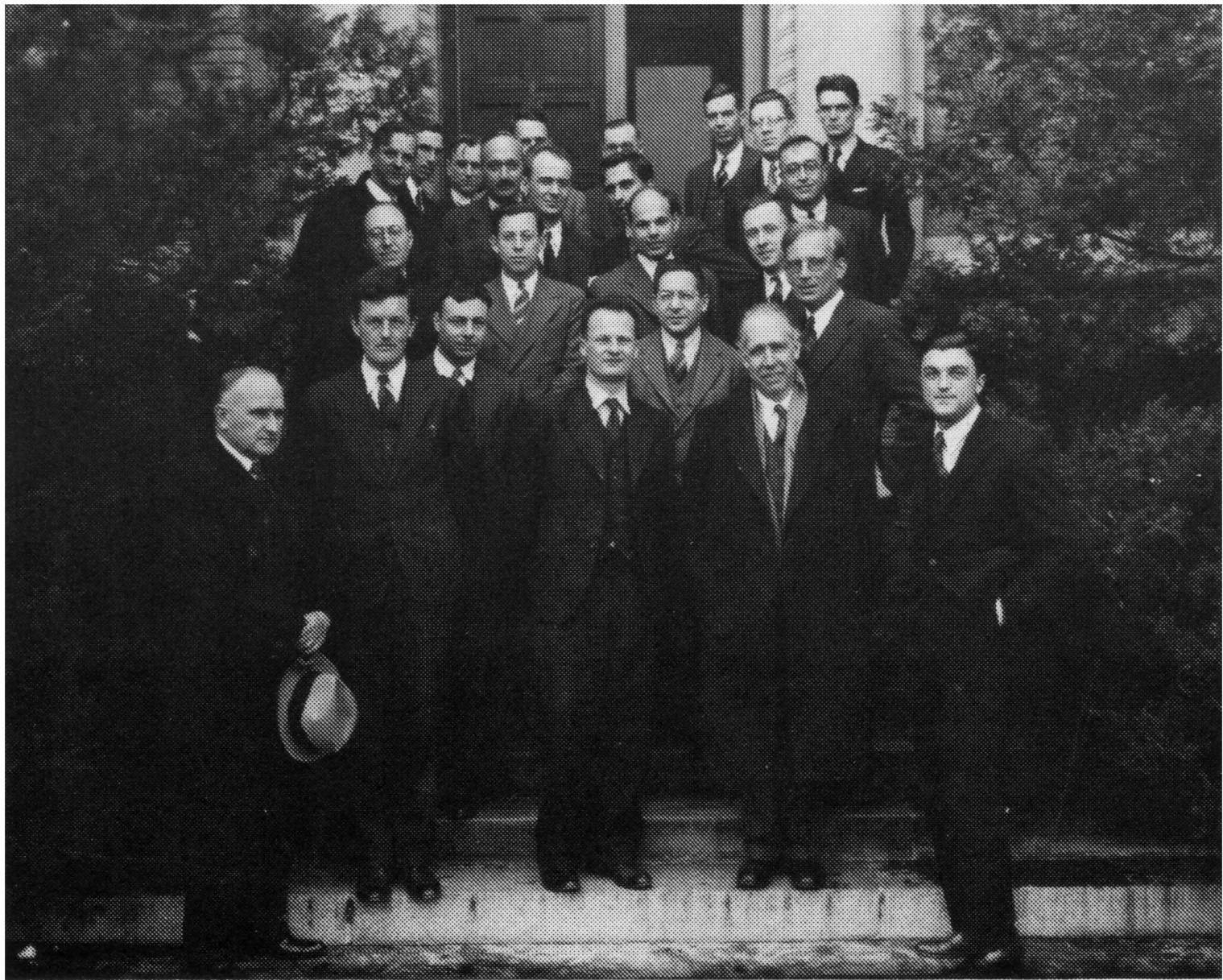










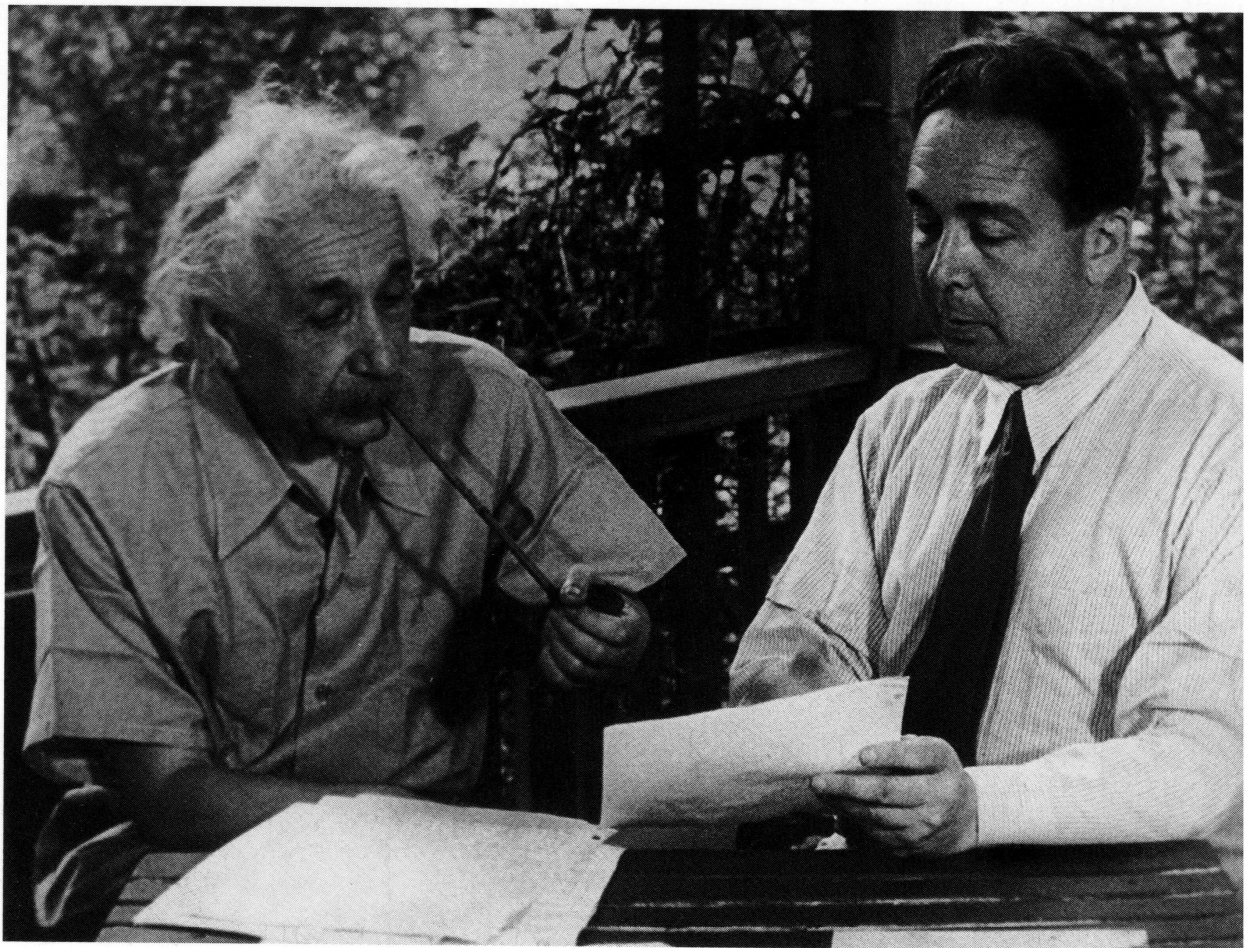


A galaxy of famous physicists gathered in front of Princeton's Sayre Hall to celebrate the success of the Mike thermonuclear test in November 1952. Niels Bohr is second from the right in the front row (wearing a scarf). Hans Bethe is to Bohr's right. Immediately behind them on the right of the second row are George Gamow and I. I. Rabi. John A. Wheeler is behind Gamow, and Eugene Wigner is at the extreme left of the second row. Teller is partially obscured in the center of the next to last row.



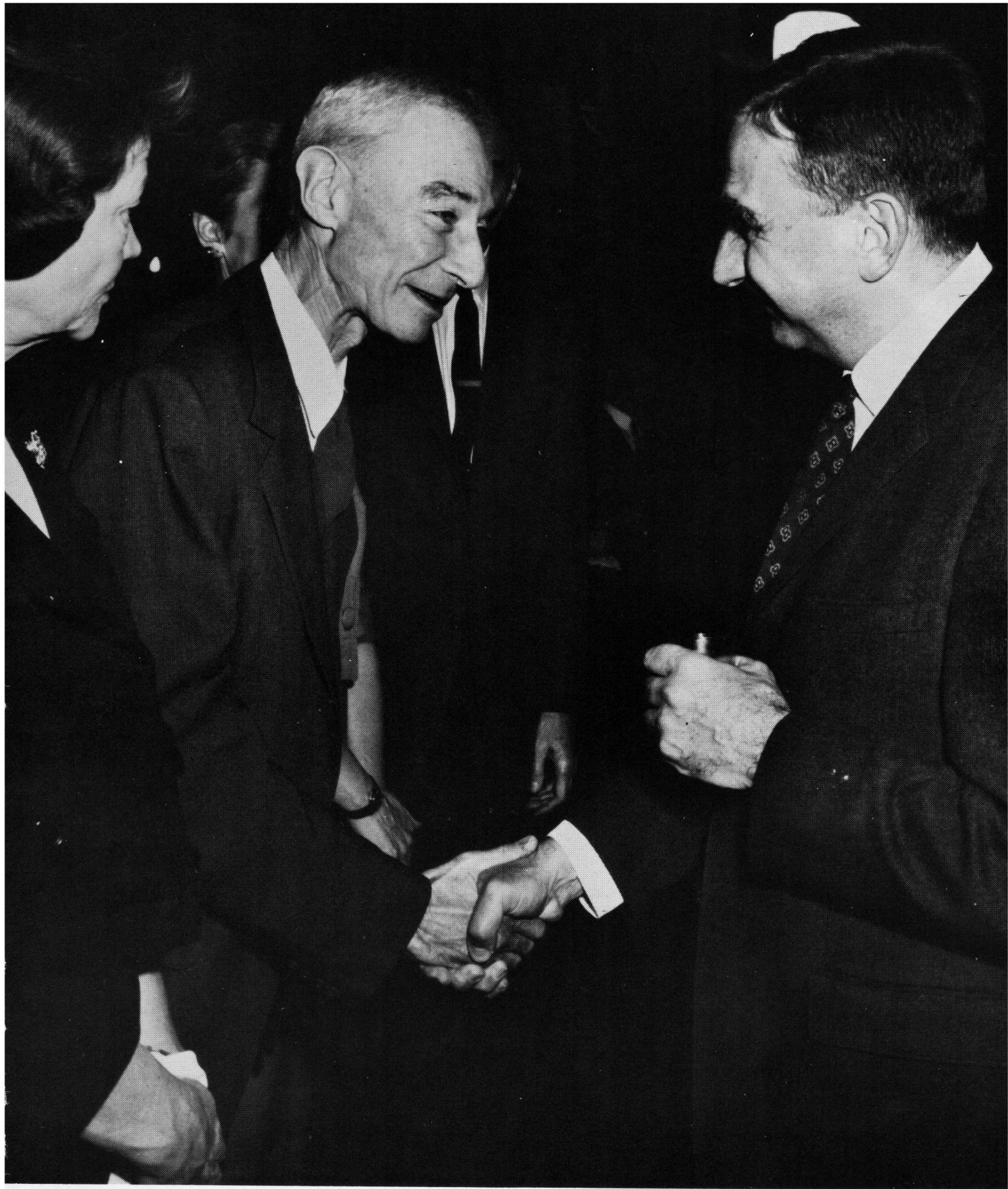


3. Both Danish Nobel laureate Niels Bohr (pictured right) and German Nobel laureate Werner Heisenberg visited America in 1939. Working with American physicist John Wheeler at Princeton, Bohr identified the role of U-235 in nuclear fission. Heisenberg faced intense interrogation from his colleagues about his reasons for returning to do physics in Nazi Germany. (Photograph by Paul Ehrenfest, Jr, courtesy AIP Emilio Segrè Visual Archives, Weisskopf Collection)



4. Persuaded by the 'Hungarian conspiracy' – Leo Szilard, Edward Teller and Eugene Wigner – Albert Einstein agreed to sign a letter to US President Franklin Roosevelt. The letter warned of 'extremely powerful bombs of a new type'. In this picture, taken in the late 1940s, Einstein and Szilard recreate the moment. (Time & Life Pictures/ Getty Images)



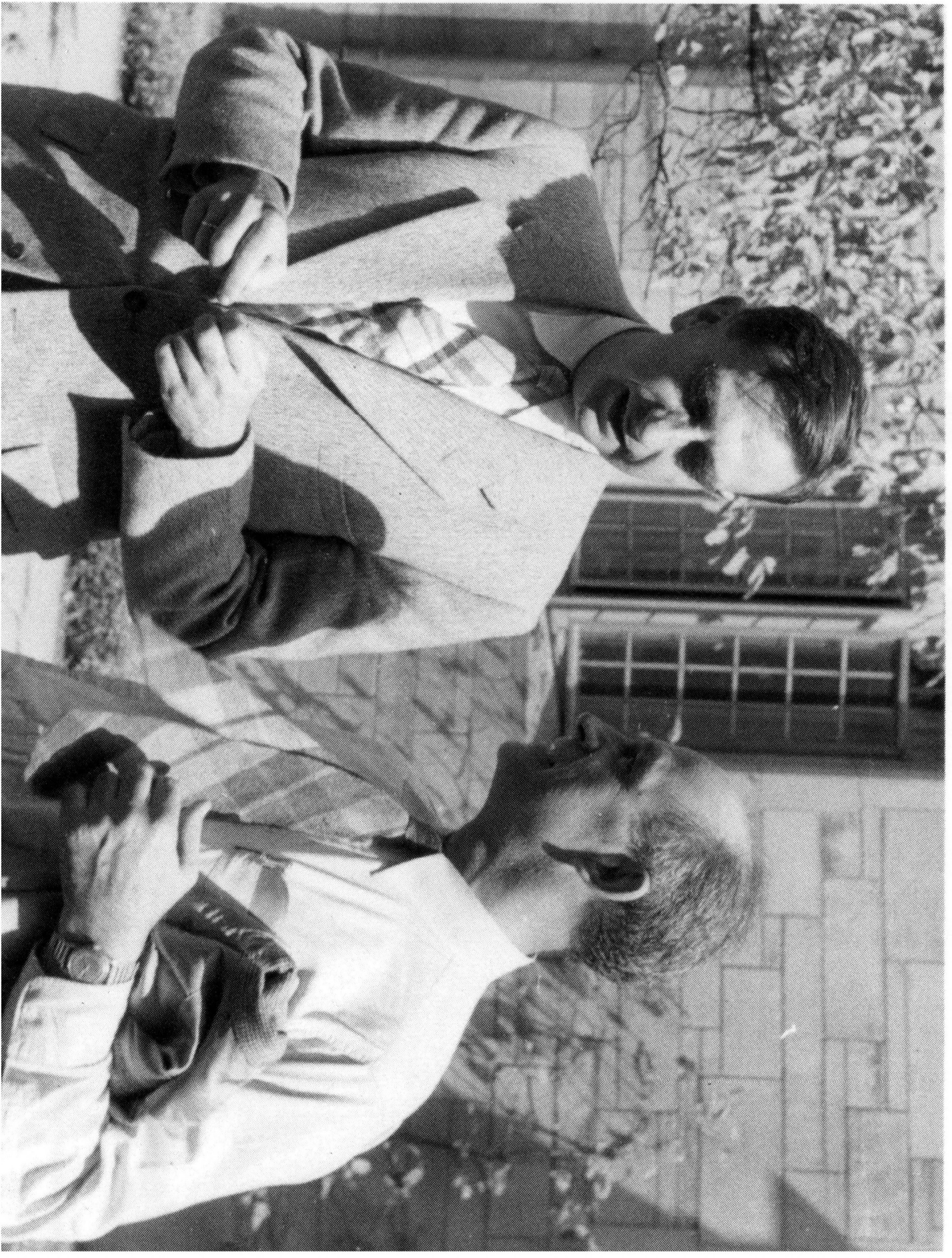


On December 2, 1963, exactly ten years after he was charged with being a security risk, J. Robert Oppenheimer received the prestigious Fermi Award from President Lyndon Johnson. After the White House ceremony, Teller, who had won the award in 1962, warmly congratulated his longtime rival. At the time the gesture seemed to symbolize the end of the long and bitter rivalry between the supporters of the rival scientists, but the ill feeling, though Teller and Oppenheimer may have personally made their peace, continued to divide the scientific world for at least another decade.

(Ralph Morse. Time-Life Picture Agency (© Time Inc.))



*Telle & Form, Chicago, Ill.*







K. E. J. Fuchs

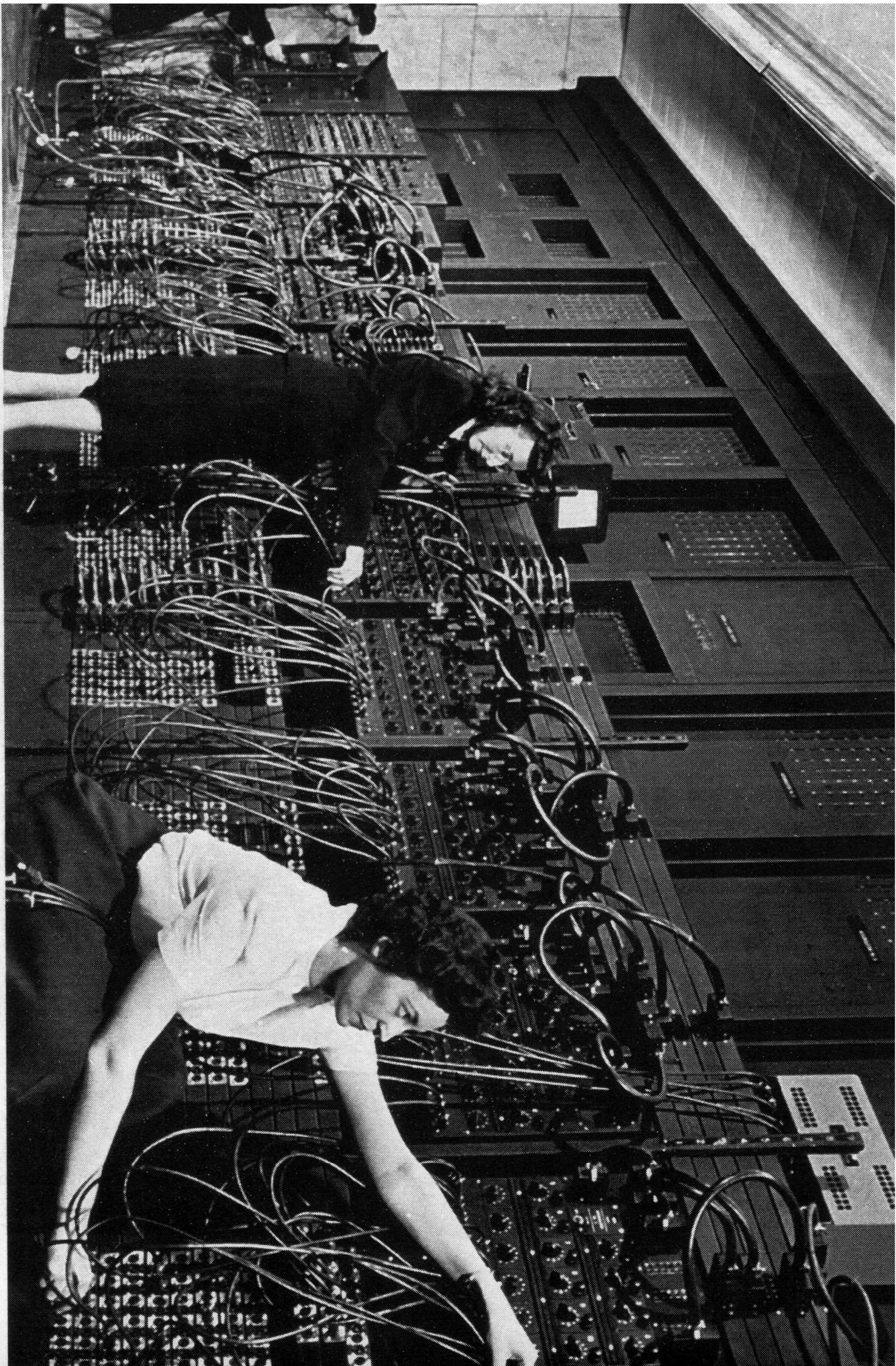


Dr. Nathan May, SP4





ENIAC 1st Bomb Computer 1946









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# Field Engineering and Mine Warfare



PAMPHLET No. 3

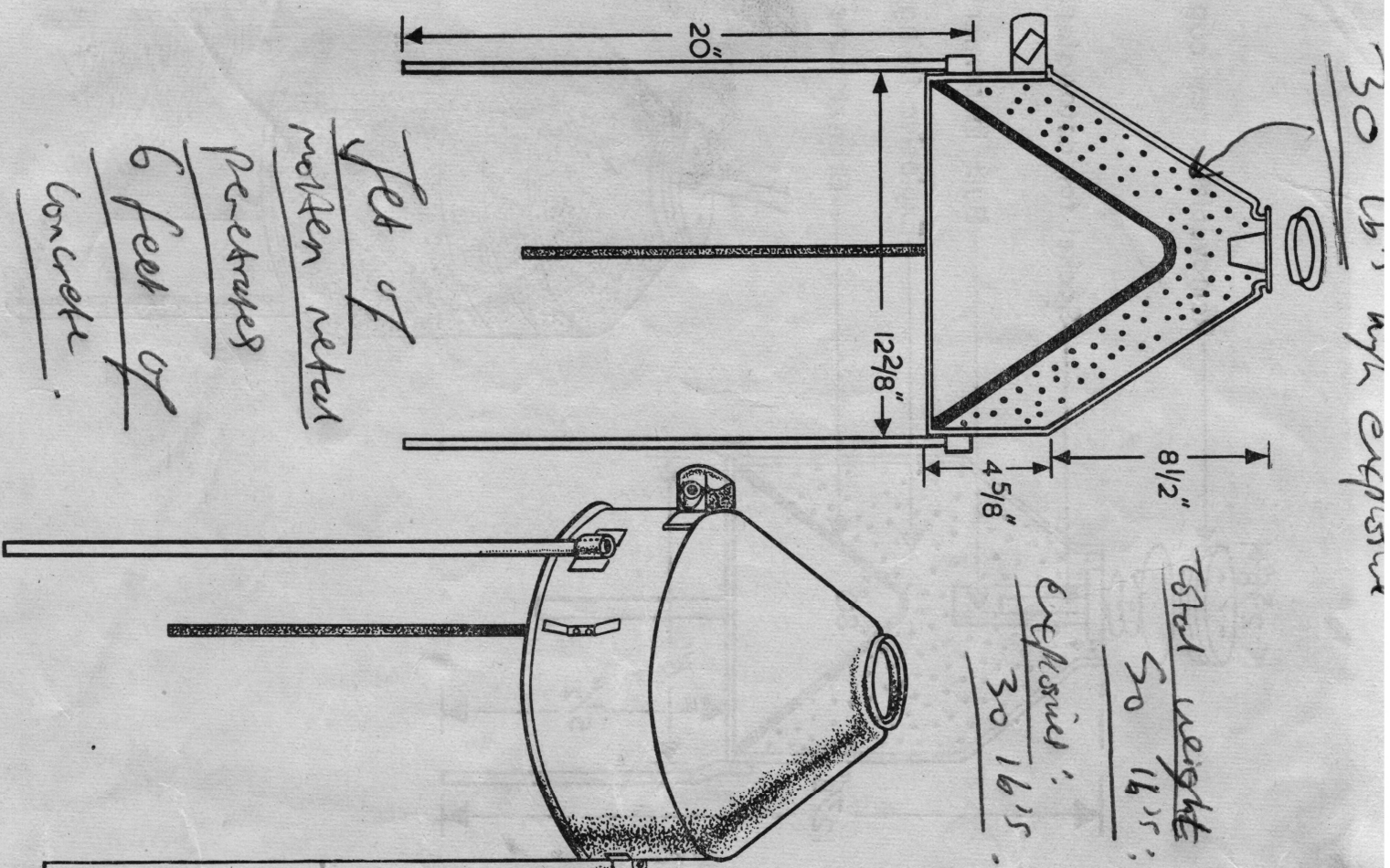
## DEMOLITIONS

PART II - RE AND INF ASLT PNRS

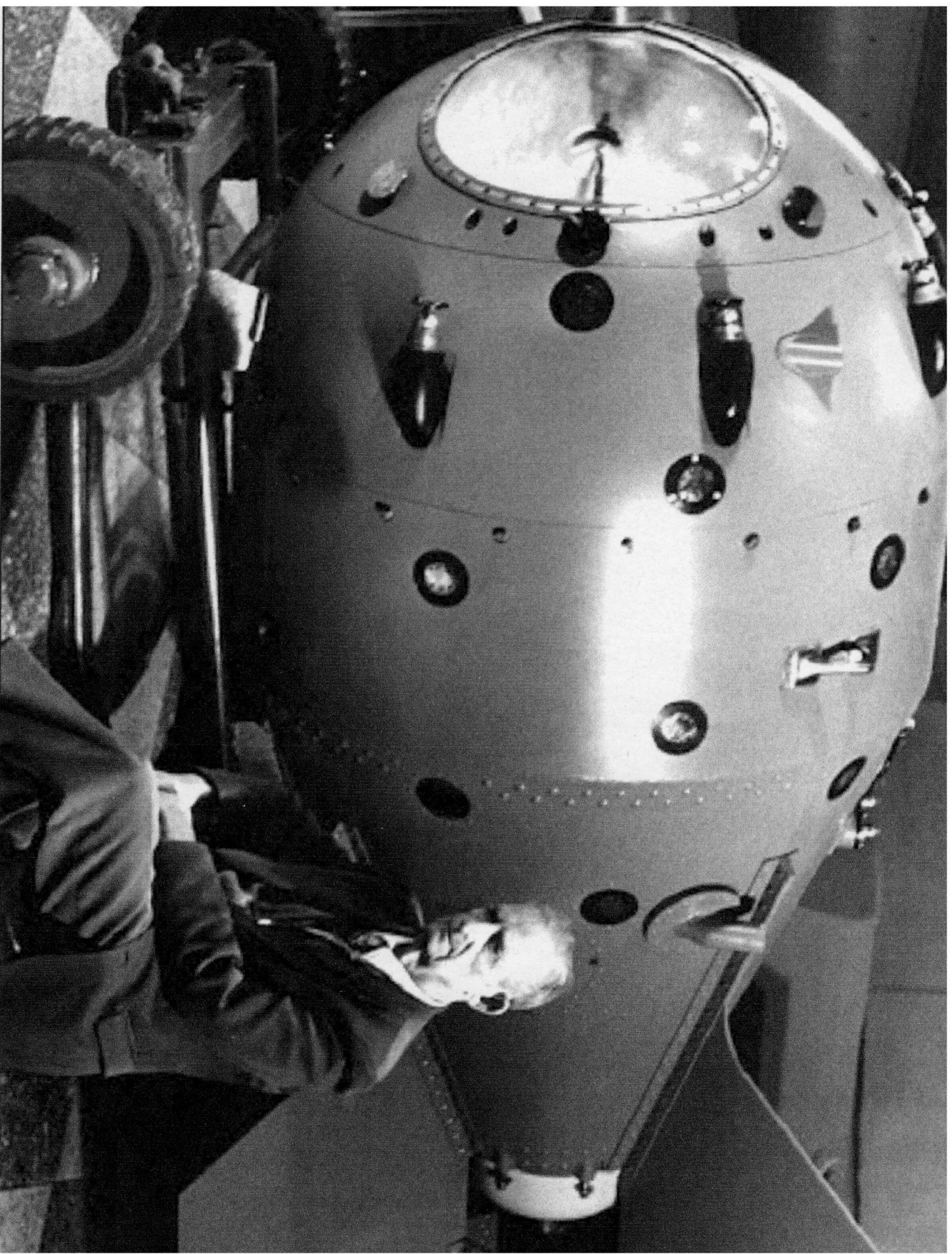
1955

*Prepared under the direction of  
The Chief of the Imperial General Staff.*

THE WAR OFFICE,  
August, 1955.







Yuriy B. Khartov, one of the key figures of the Soviet nuclear weapons program, sitting next to 'his



BRITAIN

*and*

ATOMIC  
ENERGY

1939-1945

MARGARET GOWING



NOTES:

# BRITAIN AND ATOMIC ENERGY

1. UK called  
bomb project  
"Tube Alloys"  
due to endorsing  
U235 enrichment  
by  $UF_6$  gaseous  
diffusion method.

1939-1945

2. In 1943, UK-USA Collaboration  
broke down: USA rejected both

MARGARET GOWING B.Sc. (Econ.)  
Historian and Archivist, United Kingdom  
Atomic Energy Authority

the "cascade of cascades"  
enrichment method (they used only  
With an introductory chapter by  
Kenneth Jay

a single cascade!), and USA  
also rejected the "rabbit  
principle".

3. UK supplied powdered nickel,  
from Mond Nickel Co.,  
in Wales.

London, Macmillan & Co Ltd  
New York, St Martin's Press



1964.

3000 tons of powdered nickel  
were shipped from UK to USA  
up to June 1945 for making  
 $UF_6$  barrier membranes.  
(Page 256.)



# APPENDIX 1 The Frisch-Peierls Memorandum<sup>1</sup>

1940

## On the Construction of a 'Super-bomb'; based on a Nuclear Chain Reaction in Uranium

Uranium  
The critical radius  $r_0$  — i.e. the radius of a sphere in which the surplus of neutrons created by the fission is just equal to the loss of neutrons by escape through the surface — is, for a material with a given composition, in a fixed ratio to the mean free path of the neutrons, and this in turn is inversely proportional to the density. It therefore pays to bring the material into the densest possible form, i.e. the metallic state, probably sintered or hammered. If we assume, for  $^{235}\text{U}$ , no appreciable scattering, and 2.3 neutrons emitted per fission, then the critical radius is found to be 0.8 times the mean free path. In the metallic state (density 15), and assuming a fission cross-section of  $10^{-23} \text{ cm}^2$ , the mean free path would be 2.6 cm and  $r_0$  would be 2.1 cm, corresponding to a mass of 600 grams. A sphere of metallic  $^{235}\text{U}$  of a radius greater than  $r_0$  would be explosive, and one might think of about 1 kg as a suitable size for the bomb.

If the reaction proceeds until most of the uranium is used up, temperatures of the order of  $10^{10}$  degrees and pressures of about  $10^{13}$  atmospheres are produced. It is difficult to predict accurately the behaviour of matter under these extreme conditions, and the mathematical difficulties of the problem are considerable. By a rough calculation we get the following expression for the energy liberated before the mass expands so much that the reaction is interrupted:

$$E = 0.2 M (r^2 / \tau^2) (\sqrt{r/r_0} - 1) \quad (1)$$

( $M$ , total mass of uranium;  $r$ , radius of sphere;  $r_0$ , critical radius;  $\tau$ , time required for neutron density to multiply by a factor  $e$ ). For a sphere of diameter 4.2 cm ( $r = 2.1$  cm),  $M = 4700$  grams,  $\tau = 4 \times 10^{-9}$  sec, we find  $E = 4 \times 10^{22}$  ergs, which is about one-tenth of the total fission energy. For a radius of about 8 cm ( $M = 32$  kg) the whole fission energy is liberated, according to formula (1). For small radii the efficiency falls off even faster than indicated by formula (1) because  $\tau$  goes up as  $r$  approaches  $r_0$ . The energy liberated by a 5 kg bomb would be equivalent to that of several thousand tons of dynamite, while that of a 1 kg bomb, though about 500 times less, would still be formidable.

The fission of uranium results in the formation of a great number of active bodies with periods between, roughly speaking, a second and a year. The resulting radiation is found to decay in such a way that the intensity is about inversely proportional to the time. Even one day after the explosion the radiation will correspond to a power expenditure of the order of 1000 kW, or to the radiation of a hundred tons of



UK, NATIONAL ARCHIVES: CAB104/227.

## APPENDIX 2 The Maud Reports

NOTE:

UK, PRIVATE SECRETARY TO  
LORD HANNKEY, JOHN CAIRN CROSS  
GAVE THIS SECRET REPORT TO MR

Report by M.A.U.D. Committee on the Use of

Uranium for a Bomb JULY 1941

STALIN VIA NKVD SPY ANATOLY

GORSKY (ALIAS USSR EMBASSY

1. General Statement

ATTACHE, ANATOLY GROMOV)!

if the war should end before the bombs are ready the effort would not be wasted, except in the unlikely event of complete disarmament, since no nation would care to risk being caught without a weapon of such decisive possibilities.

We know that Germany has taken a great deal of trouble to secure supplies of the substance known as heavy water. In the earlier stages

The best estimate of the kind of damage likely to be produced by the explosion of 1,800 tons of T.N.T. is afforded by the great explosion at Halifax N.S. in 1917. The following account is from the *History of Explosives*.<sup>1</sup> 'The ship contained 450,000 lb of T.N.T., 122,960 lb of guncotton, and 4,661,794 lb of picric acid wet and dry, making a total of 5,234,754 lb. The zone of the explosion extended for about  $\frac{3}{4}$  mile in every direction and in this zone the destruction was almost complete. Severe structural damage extended generally for a radius of  $1\frac{1}{8}$  to  $1\frac{1}{4}$  miles, and in one direction up to  $1\frac{3}{4}$  miles from the origin. Missiles were projected to 3-4 miles, window glass broken up to 10 miles generally, and in one instance up to 61 miles.'

In considering this description it is to be remembered that part of the explosives cargo was situated below water level and part above.

of material. Calculations of the efficiency have been made by Professor Peierls and in more detail by Dr M. H. L. Pryce. The results show that efficiencies of from 1 to 10% may be obtained, depending upon the ratio of the mass to that of the smallest amount of uranium in which a divergent chain reaction is possible and on certain other factors. It should be remembered that a uranium bomb with an efficiency of 1% would release as much energy as 180,000 times the weight of T.N.T.



MAUD report states  
 Liverpool exp. gave 1.5  
 neutrons fission  
 XS for U235

Appendix 2

Critical Mass in Kilos

Assumptions  
 0.8 m.e.v neutrons  
 Tamping  
 Cross-  
 $1.5 \times 10^{-24}$

3 Neutrons per fission:

(Plutonium 239)

Cross-section for collision	$4 \times 10^{-24}$	Untamped	17.2
Allowance for diffraction	$1 \times 10^{-24}$	Fully <sup>1</sup> tamped	5.16

2.5 Neutrons per fission:

(U-235):

Cross-section for collision	$3.5 \times 10^{-24}$	Untamped	42.7
Diffraction ignored		Fully <sup>1</sup> tamped	13.2

<sup>1</sup> A shell of material of a thickness two or three times the radius would give a result approximating to the fully tamped



### 8. *Estimate of damage*

The 10 kg bomb we are supposing could readily be given an efficiency of 2% and the resulting release of energy will be equivalent to that of 3,600 tons T.N.T.

In considering such a proposal it is first necessary to be sure that the release of very large quantities of energy from a small mass will in fact do the damage that might be expected from experience with ordinary explosives. In the absence of such a bomb this can only be dealt with by calculation. Professor G. I. Taylor has examined this point for us and reports, 'the wave at big distances is quite comparable in pressure and in duration with that produced by the amount of T.N.T. which releases the same energy as your U bomb'. The exact ratio depends on detailed assumptions but it is not far from one-half, i.e. twice the energy release is needed from the U bomb to give the effect of T.N.T. Thus the damage done by a 10 kg bomb will be equal to that of 1,800 tons of T.N.T. Professor Taylor<sup>1</sup> has calculated the pressures at various distances due to the U bomb but as they last for much longer than those for experimental quantities of T.N.T., and so will probably do more damage, it is probably best to use as a standard the known effect of large accidental explosions such as that at Halifax in 1917. (Part I of this report.)

Besides the effects of the explosion, there will be very large amounts of radioactive material produced which will be scattered over the area affected by the explosion. It is in fact known that the products of the fissions are  $\beta$  active, passing through a number of transformations before becoming inert. It is very difficult to estimate the extent of their effect especially as the most important substances would be those of long life, which are the hardest to study under laboratory conditions. It does however seem certain that the area devastated by the explosion would be dangerous to life for a considerable time. The physiological effects of these radiations are delayed and cumulative so that great care would have to be taken in working anywhere near. If this were realised, the danger to life from this cause would probably be small compared with that due to the actual explosion.

### 9. *Problems of Development*

The main problem is the production of relatively very large quantities of separated isotopes. Secondary ones are the arrangements for producing the explosion when and where required.

<sup>1</sup> Appendix V.



(2) The use of nuclear energy to provide an explosive involves the following processes:

- (a) Production of  $\text{UF}_6$ .
- (b) Separation of the reactive isotope.
- (c) Production of massive uranium metal (235) from  $^{235}\text{UF}_6$ .

The production of 1 kg per day of  $^{235}\text{U}$  involves the manufacture of 450–650 kg/day of  $\text{UF}_6$ , and it is considered that this quantity of  $\text{UF}_6$  can be made on a commercial scale. The process which is recommended is the one which has been used for the preparation of 3 kilos of  $\text{UF}_6$  for M.A.P. and involves the direct reaction between fluorine and metallic uranium. A plant to manufacture 450 kilos per day of  $\text{UF}_6$  would cost approximately £100,000. The whole plant could be completed in approximately eighteen months if certain investigations are started at once.

The separation of the reactive isotope in a diffusion plant of the type suggested by Professor Simon appears to us to be practicable on the scale up to 1 kg  $^{235}\text{U}$  per day. The total capital expenditure for a plant of this size is estimated to be about £5,000,000.

If every possible effort is made we believe that a separation unit could be ready for testing by March 1st, 1942, and the detailed design of the actual units for the plant should then be ready between June and September 1942. During this time plans could be prepared for the full-scale plant and preliminary work could be started on the site.

After August 1st, 1942, we consider that manufacture of separation units could start and in six months (i.e. by February 1st, 1943) a steady output of these units would be going to the factory site. These would be installed and production of  $^{235}\text{UF}_6$  could be started in the autumn of 1943 and the first bomb would be produced by the end of 1943. Within a year the plant would be producing 30 kg per month (1 kg ( $^{235}\text{U}$ ) per day), if this output were required.

This estimate is not based upon any firm figures for speed of production given by Messrs Metropolitan-Vickers, but it is given after a thorough discussion with Dr Guy on the assumption that the highest priority is given to the production of the units in the engineering shops where they would be made.

The  $^{235}\text{UF}_6$  separated in such a plant can be converted to metallic uranium (235).

(3) The essential raw material for the process is uranium, of which the known supplies are very limited geographically. The two most important sources of the ore are in the Belgian Congo and Canada.



The ore is now mined for its radium content and the output of uranium before the war was approximately 300 tons/year.

There is a stock in Canada of probably 500 tons of uranium. In this country there is sufficient for research and development of the process of making metallic uranium.

For the manufacture of  $\text{UF}_6$  we recommend that the metallic uranium should be made by reducing the oxide with calcium hydride. The fluorine could be recovered from treated  $\text{UF}_6$  and used again to react with more uranium.

(4) The diffusion process for the separation of the reactive isotope has now reached a stage of development at which we recommend that a production committee should take charge of the problem. This committee would see that all the problems to be solved for the construction of a full-scale plant were investigated so that the results would be ready as they were required. It would also examine and report on the cost of smaller plants if, for technical or other reasons, it was considered desirable to produce less than 1 kilo per day. The committee would recommend a suitable site for the plant.

I.C.I. is prepared to take executive charge of this work on behalf of the M.A.P. The arrangement would be similar to that already made in other cases with this Ministry.

### *Cost of Uranium Bombs*

Capital cost of the Isotope Separation Plant to make

360 kilos per year

£5,000,000

Working cost for 1 year

£1,500,000

Cost of uranium and other materials

£2,000,000

Cost of case and charging 36 bombs at £300

£10,000

---

£8,510,000

---

If the total cost is charged to the 36 bombs cost per  
bomb is each

£236,000

(One bomb is equivalent to 1,800 tons T.N.T.)



*Cost of T.N.T. Bomb*

Capital cost of T.N.T. plant to make 65,000 tons per year	£5,050,000
Cost of manufacture at £90 per ton	£5,850,000
Cost of case and charging of 65,000 bombs each containing 1 ton T.N.T. at £50 per bomb	£3,250,000
	<hr/>
	£14,150,000
	<hr/> <hr/>

If the total cost is charged to the 65,000 bombs the cost per bomb is	each	£218
and the total cost of 1,800 tons T.N.T. in bombs would be		£392,000

## APPENDIX II TO M.A.U.D. REPORT

*Extract from letter from Dr R. Ferguson, Research Department,  
Woolwich*

If the weights of the two approaching bodies are of the order of 10 kg each, no especial difficulty is foreseen in imparting to each of these bodies a velocity of the order of 3,000 ft/sec. The major difficulty which at present I foresee would be to ensure that under the conditions of set-back and set-forward the condition of the material packed in the moving bodies remained satisfactory. This could, I think, be determined only by actual trial.

Provided that the weight of the two bodies to be projected is, as I have indicated above, to be of the order of 10 kg, the time required to work out the method by means of which a velocity of 3,000 ft/sec could be imparted to each of them simultaneously would be approximately 1-2 months, if the work were put on high priority and if the necessary staff were available.

*July 1941*



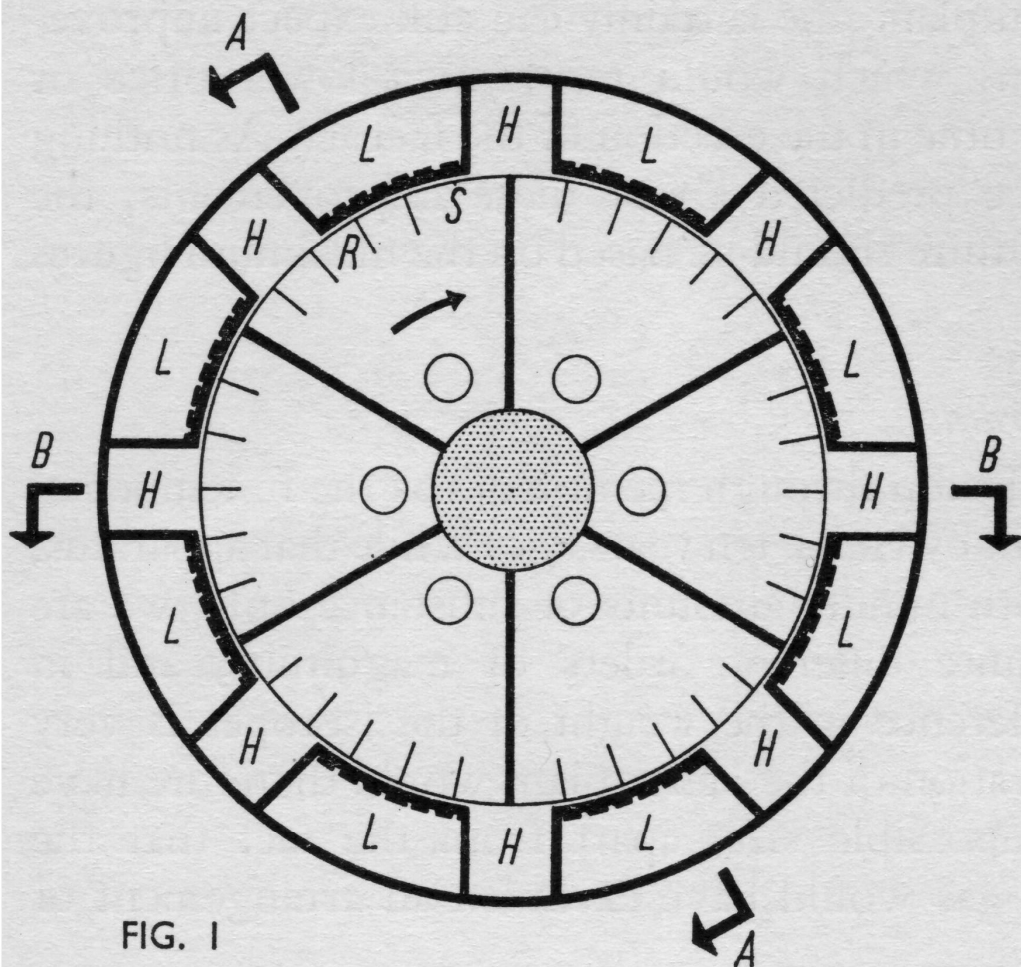


FIG. 1

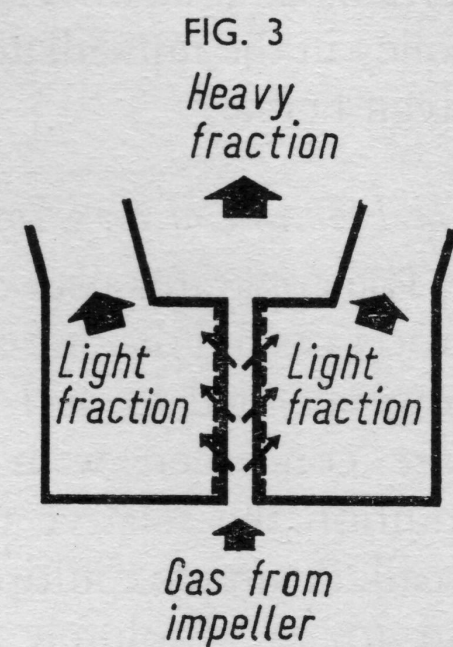


FIG. 3

— Key —  
 ----- Membranes

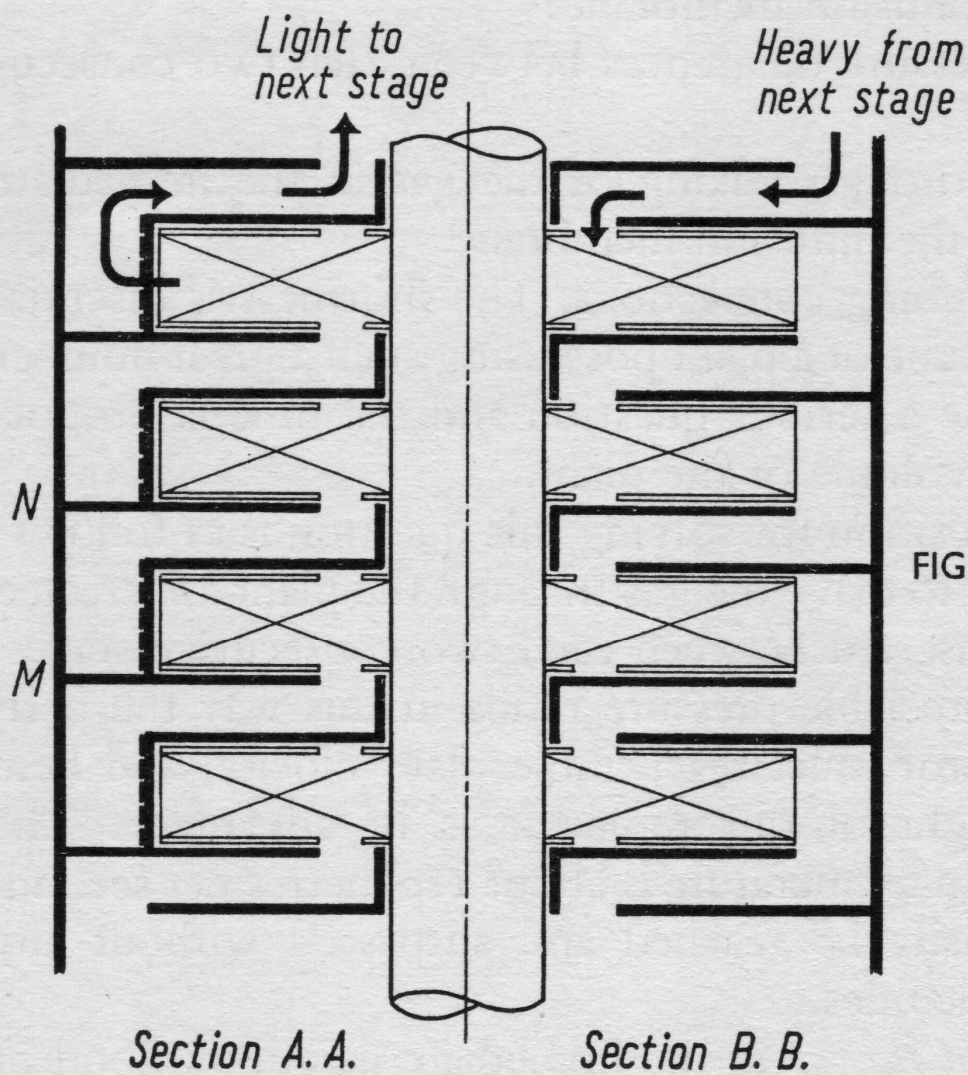


FIG. 2



membrane is fixed near its periphery. The gas enters somewhere near the axis and is pressed through the membrane, while at the same time the gas in the immediate neighbourhood of it is stirred thoroughly. The light isotope diffuses preferentially through the membrane while at the other side of the membrane a fraction richer in the heavy isotope gradually accumulates, progressing from *R* to *S*. This part, which is almost equal to that passing through the membrane, is ejected through the opening *H* after which the cycle begins anew. The length of the section of the membrane and, what is equivalent, the number of membranes at any one cross section, depends on the properties of the membrane and the velocity of the blades.

In Figure 2 a sketch of an assembly of a few stages is given as a cross section. The left-hand side of the figure shows a cross section through the diffusing membrane while on the right-hand side the plane of the drawing crosses one of the channels through which the heavy fraction is removed. The light fractions are passed on to the next stage in a way easily to be understood from the figure, while the heavy fractions are handed back to the previous stage. It can be seen that by repeating the parts between *N* and *M* the whole plant could be built up quite simply without complicated tube connections and so on.

(B) Peierls has proposed recently another solution for the question of mixing the gas which dispenses with the mechanical stirring. The idea is to force the gas through a narrow space (Figure 3) of which two membranes form the walls. Some of the gas diffuses through these membranes and this leaves the gas near the walls poor in light isotope. If the distance of the two walls from each other is kept sufficiently small this loss of light component will, by diffusion, be spread uniformly over the whole width. The gas therefore travels along the membrane pair with uniform but steadily decreasing content of light isotope. At the end of the pair just half the amount put in remains and this residue forms the heavy portion. The gas which has diffused through the membrane into the space outside the membrane pair forms the light fraction. The dimensions of the pair depend on the characteristics of the membrane (hole size and permeability) and it should be mentioned that with the membranes at present at our disposal the dimensions remain within reasonable limits; for instance, the distance between the two membranes is of the order of  $\frac{1}{2}$  to 1 mm.

The gas can be supplied to such an arrangement by any means as the blades do not serve the double purpose as in (A) and therefore one can consider employing quite different types of compressors. One can show,



available which can be used for sealing purposes. No entirely satisfactory liquid, however, has yet been found, either for lubricating purposes or for use in a centrifugal seal. It seems, therefore, certain that the bearings have to run in an atmosphere free from our gas and thus the provision of glands is essential. We have given much attention, together with Metropolitan-Vickers, to this point, and we are convinced that a labyrinth gland of conventional construction together with the use of a buffer gas, which at intervals is removed from our gas, will give a satisfactory solution.

Experiments with models of different sizes have shown that peripheral speeds of the rotor even twice as high as the velocity of sound do not give rise to appreciable heat of friction in the gas at our working pressures, which are of the order of 1 to 2 mm. One therefore can create pressure ratios of 4 or 5 to 1 without encountering any difficulties in removing the heat of friction and a very compact machine is possible.

A great number of experiments have been carried out for the production of suitable membranes by rolling wire gauzes. The best results obtained so far have been achieved with 450 mesh gauze which allowed the production of holes of a diameter of  $10^{-4}$  cm and a permeability of the membrane of 3%. Experiments in Professor Thomson's Laboratory have given a value of the viscosity and therefore of the mean free path, and one can deduce from these results that at a pressure of 2 mm mercury the mean free path will be equal to this hole size and thus result in satisfactory separation.

Experiments were carried out on the actual separation of two gases of about the same molecular weight as our gas but with a much bigger difference so that even a single stage can give separations which can be measured. Experiments with arrangement (A) have not yet given final results owing to difficulties of a secondary nature. Experiments with a membrane pair, however, have been carried out successfully and the separations attained show an effect of the right order. More accurate data as well as data on (A) can be expected within a short time.

In conclusion we can state, and this is also the opinion of Metropolitan-Vickers, that there do not seem to exist any indications that a plant of this type cannot be built, although much attention has, of course, still to be given to details.

### *The Size of the Plant*

In order to keep the size and consequently the price down one has to make the maximum use of the output of each impeller. Under our



size of the plant between the input stage and the output of the light fraction. The size of the part between input and output of the heavy fraction depends on the concentration of the reject which we choose. The choice is determined by the relative costs of the separation plant and the plant for the production of the substance. As the former influence is by far the prevailing one it pays to reject at a relatively high concentration. We choose for this a concentration of 0.45% (the original product enters with 0.7%). This means that we have to feed to the plant, for an output of 1 kilo of metal, 0.63 tons of the compound and calculation shows that now the size of the second part of the plant is 10% of that of the first one. The total amount circulating will therefore be  $1.43 \times 10^6$  g/sec.

A 10-stage rotor of 72 cm diameter and 9 cm blade width has been chosen by Metropolitan-Vickers as the most convenient size for technical and production reasons. Such a rotor has a total surface at the periphery of  $2 \text{ M}^2$  and therefore a total output of  $2 \text{ M}^2 \times 10 \text{ M/sec} = 20 \text{ M}^3/\text{sec}$ . Our gas has a density of  $37.5 \text{ g/M}^3$  at a working pressure of 2 mm and  $25^\circ \text{C}$ . Therefore 1,900 of these units are necessary to handle the total amount.

The total area of a membrane manufactured from about 200 mesh gauze would under our conditions be about 100,000  $\text{M}^2$  or roughly 60  $\text{M}^2$  per machine. These could be accommodated in 5 concentric layers of membrane-pairs, thus adding 15 to 20 cm to the radius. The width of each pair would be 1 mm, the length 20 mm.

In the opinion of I.C.I. a convenient *size of building* for housing these machines would be  $320 \text{ ft} \times 80 \text{ ft}$  containing 400 machines so that five of these buildings would be required. These together with the auxiliary and preparation plants could easily be accommodated on a site of about 20 acres.

As regards the *power consumption* no exact figure can be given, at present, of the power required for each machine but it seems very improbable that this will exceed 10–15 kW. Allowing a margin on this and adding the power for auxiliary machinery we may assume that 20 kW per machine or 40,000 kW for the whole plant will cover the power requirements.

### *The Price of the Plant*

Metropolitan-Vickers have gone into the question of the cost of a unit of the size mentioned and they estimate that in mass production each machine would cost between £1,500 and £2,000 (say £1,750).



- (1) The electro-deposited material 'Lectromesh' might be produced at very fine mesh.
- (2) The 'Lectromesh' procedure might be utilised to produce slit type membranes which would increase the permeability (given the same working pressure). We have enquired of the makers of 'Lectromesh' about these two possibilities.
- (3) I.C.I. are conducting experiments for producing slit-type membranes by winding thin wire round a former.
- (4) According to a suggestion of Professor Lindemann's an attempt can be made to produce very small holes in thin foils by bombarding them with colloidal particles in a vacuum. Various other suggestions for perforating thin foil are also under consideration.

If any of these suggested improvements should prove successful it will affect only the *number* of machines required and not the design of each machine, so the construction of the 20-stage model will be put in hand as soon as possible. It is proposed to build this 20-stage model in two units of 10 stages each, one working according to arrangement (A), the other with arrangement (B).

## APPENDIX V TO M.A.U.D. REPORT

*The blast to be expected from a Uranium Bomb*  
by Professor G. I. Taylor, M.A., D.Sc., D.C.L., F.R.S.

If every atom in 10 kg of uranium in a uranium bomb could yield its energy the amount liberated has been calculated to be  $7 \times 10^{21}$  ergs. On the other hand it is not to be expected that more than a fraction  $\epsilon$ , which may be of order  $1/100$ th, of this energy would be liberated. Setting therefore  $7 \times 10^{21} \times \epsilon$  for  $E$  in eq. 35, the maximum pressure to be expected at distance  $R$  from the explosion is given by

$$p_{\max} = 0.155 \times 7 \times 10^{21} \epsilon R^{-3} \quad (A)$$

and the pressure in the central region is

$$\begin{aligned} p &= 0.133 \times 0.436 \times 7 \times 10^{21} \epsilon R^{-3} \\ &= 4.0 \times 10^{20} \epsilon R^{-3}. \end{aligned} \quad (B)$$

By the time the central region has reached atmospheric pressure ( $10^6$  dynes/sq cm) the maximum pressure is still

$$\frac{0.155}{0.133 \times 0.436} = 2.67 \text{ atmospheres,}$$



so that there is still more than  $1\frac{1}{2}$  atmospheres or 21 lb/sq inch excess pressure in the blast wave. The radius of the blast wave at this time is found by setting  $p=10^6$  in (B). Thus  $R^3=4\times 10^{14}\epsilon$ . Taking  $\epsilon=\frac{1}{100}$ ,  $R=(4\times 10^{12})^{\frac{1}{3}}$  cm = 160 m. At 160 m therefore the blast pressure is about 21 lb/sq in.

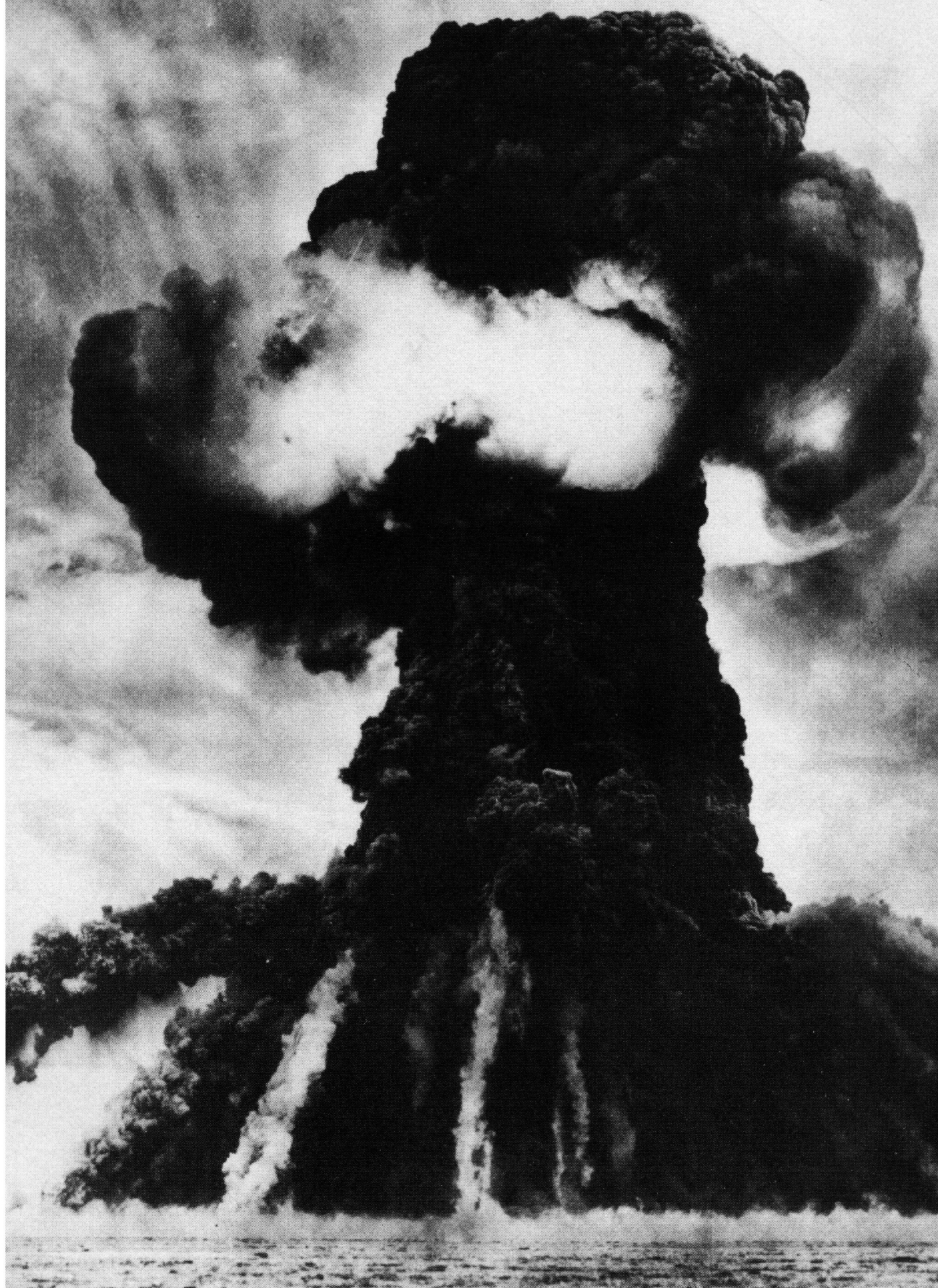
When the excess pressure is reduced below about 10 lb/sq. in. the decrease with distance is considerably less rapid than the inverse cube law. With a series of high explosive charges of various weights ranging from  $2\frac{3}{4}$  to 76 lb the excess pressure was found to decrease from 21 lb/sq. in. to 5 lb/sq. in. when the distance from the centre was doubled (this corresponds roughly with the inverse square law in this part of the range). Thus it might be expected that the pressure in the blast wave from the uranium bomb would fall to 5 lb/sq. in. at  $2\times 160=320$  m from the explosion.

The duration of the positive pressure might be expected to be much greater than that of any existing bomb. If a charge of T.N.T. were large enough to give a pressure of 5 lb/sq. in. at 320 m its diameter would be  $1/60$ th of  $320=5.3$  m = 17.5 ft. The duration of the blast at 60 charge diameters from the explosive is about  $12\times 10^{-3}\times$  (charge diameter in feet) = 210 m/sec. It seems likely that only exceptionally strong structures would survive the application of 5 lb/sq. in. for 210 m/sec. Light structure would be destroyed to a much greater distance than 320 m.

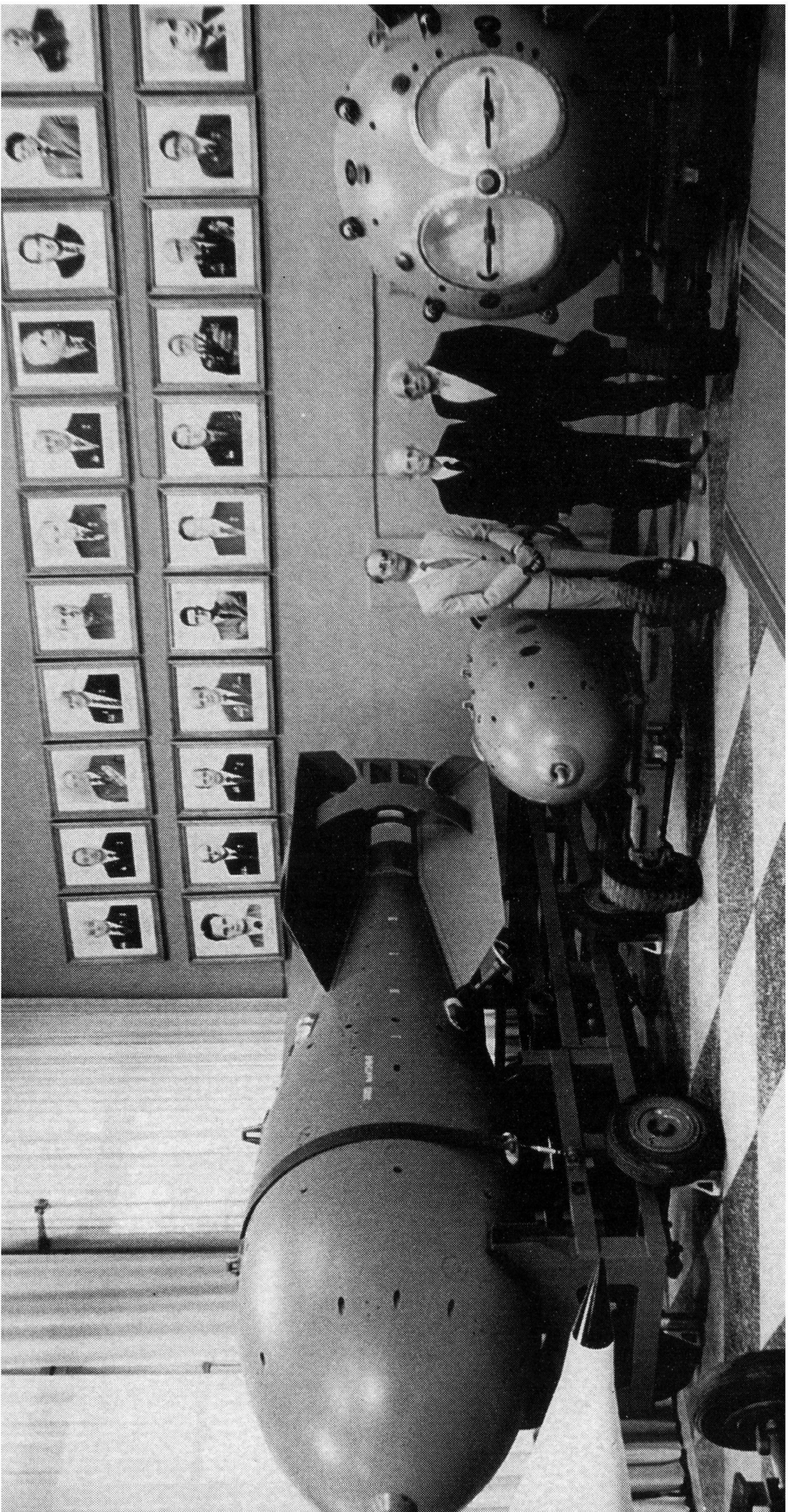
The theoretical calculation of the proportion of the total energy released from a uranium bomb which is ineffective in doing external work, and also the comparison between the measured pressure near masses of T.N.T. and C.E. with those calculated for an infinitely concentrated source emitting the same total energy, both lead to the conclusion that the blast wave from a uranium bomb would be similar to that from the mass of high explosive which releases about half as much energy. If 10 kg of uranium releases  $1/100$ th of the maximum possible energy  $7\times 10^{19}$  ergs would be released. One gramme of T.N.T. releases about 950 calories or  $4.0\times 10^{10}$  ergs so that the weight of T.N.T. which might be expected to produce blast effects equivalent to those of the uranium explosion is  $\frac{1}{2}\times \frac{7\times 10^{19}}{4\times 10^{10}}$  grammes = 900 tons.



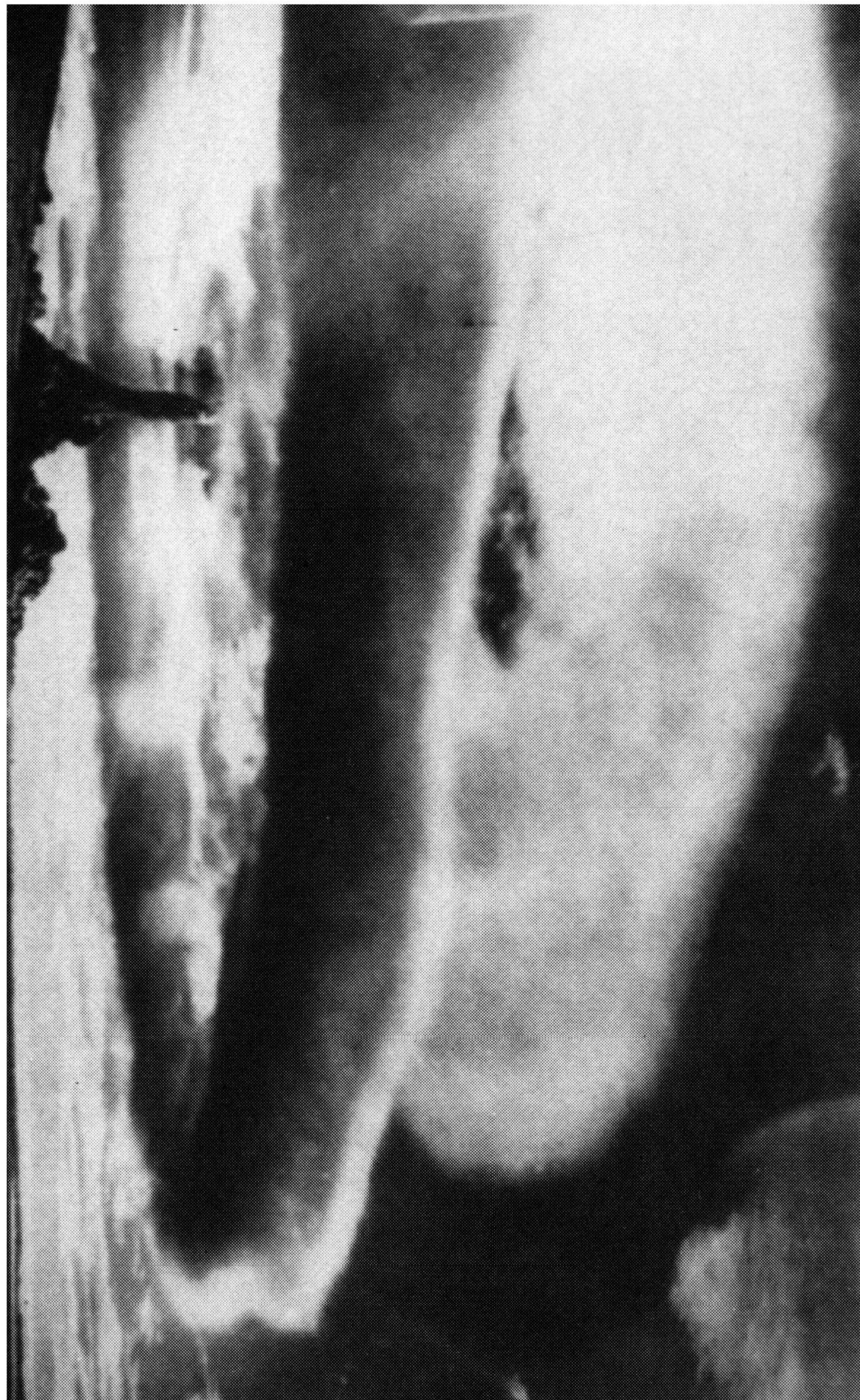
СЕМНАДЦАТИНЕСКИЙ ЯДЕРНЫЙ ПОЛЕТ



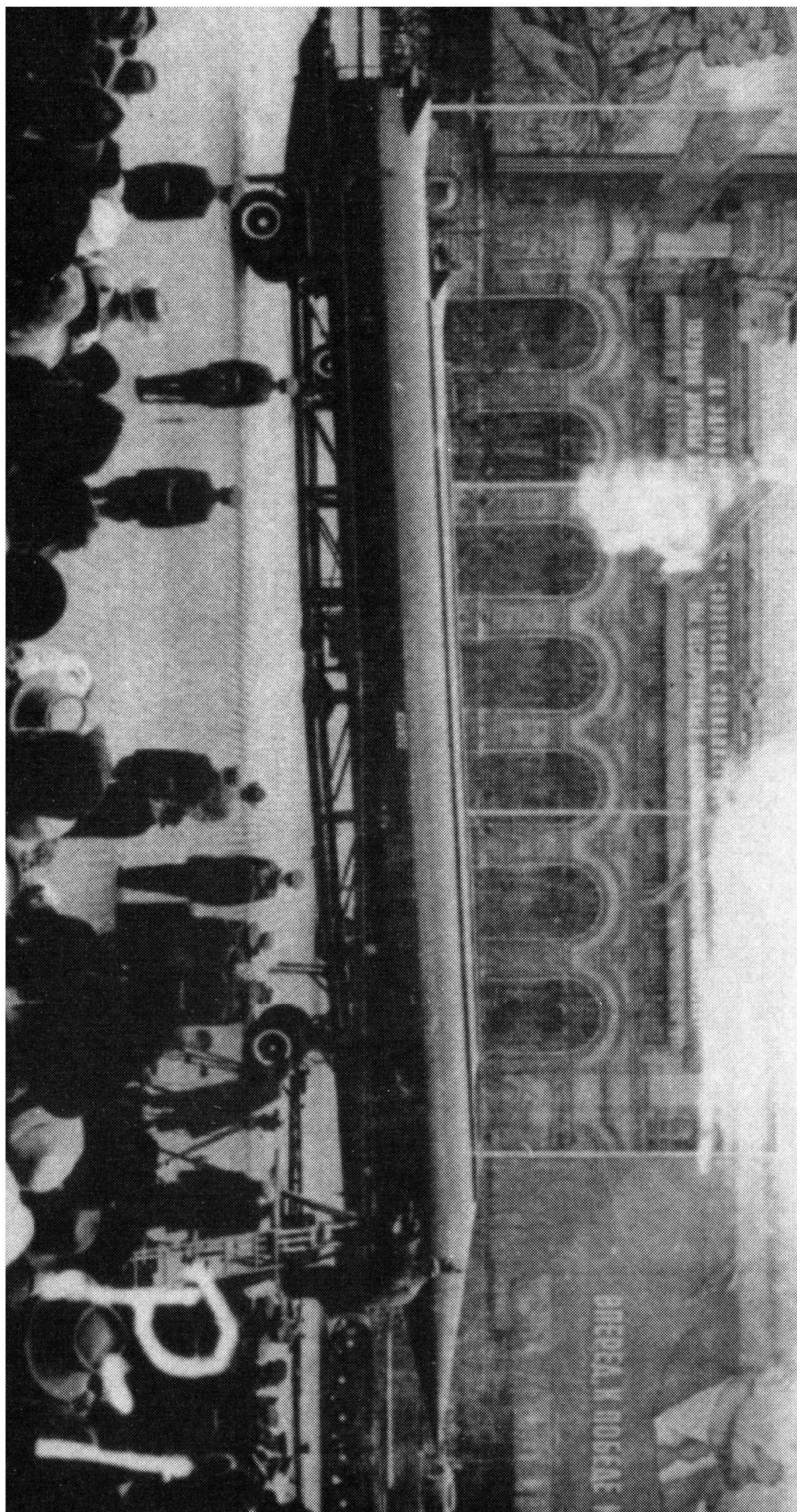




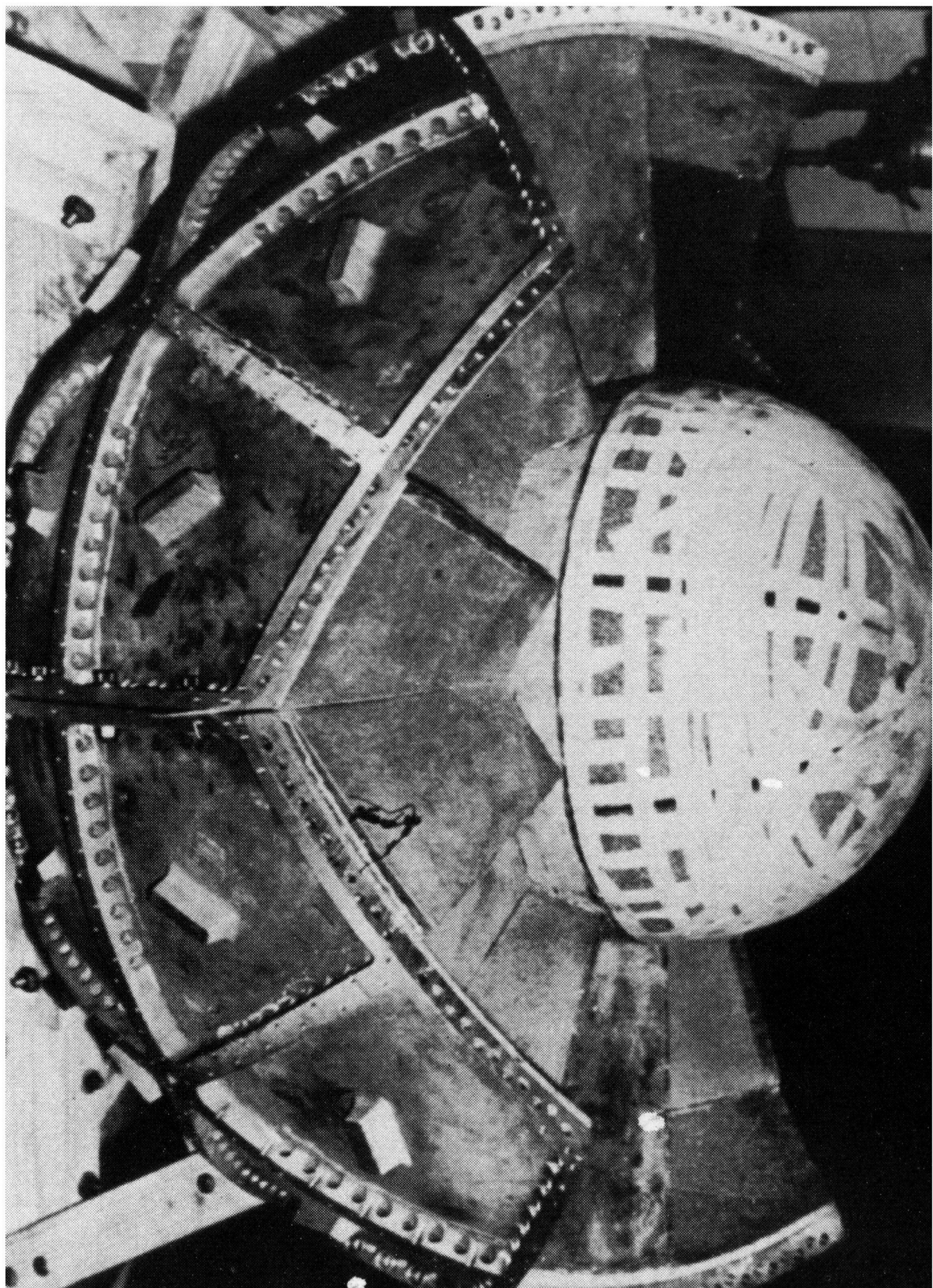






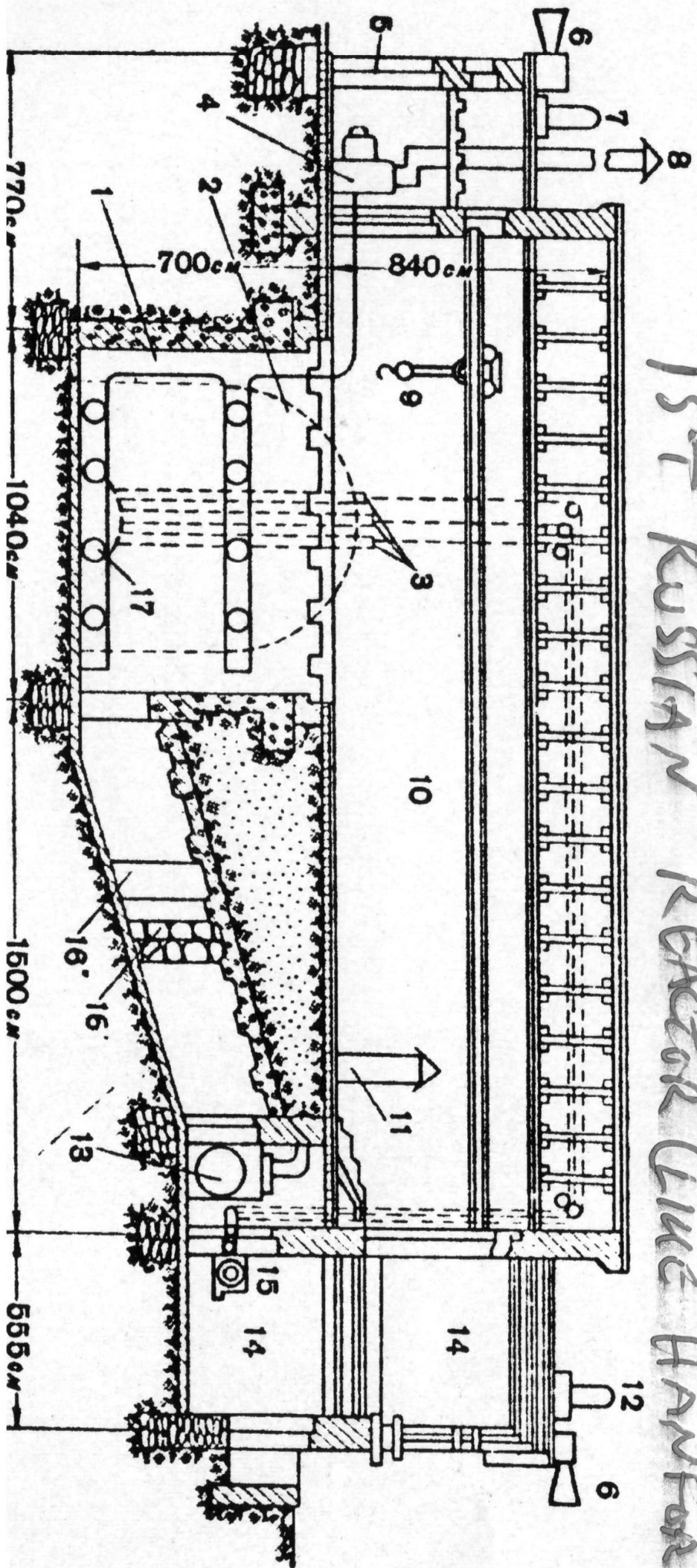








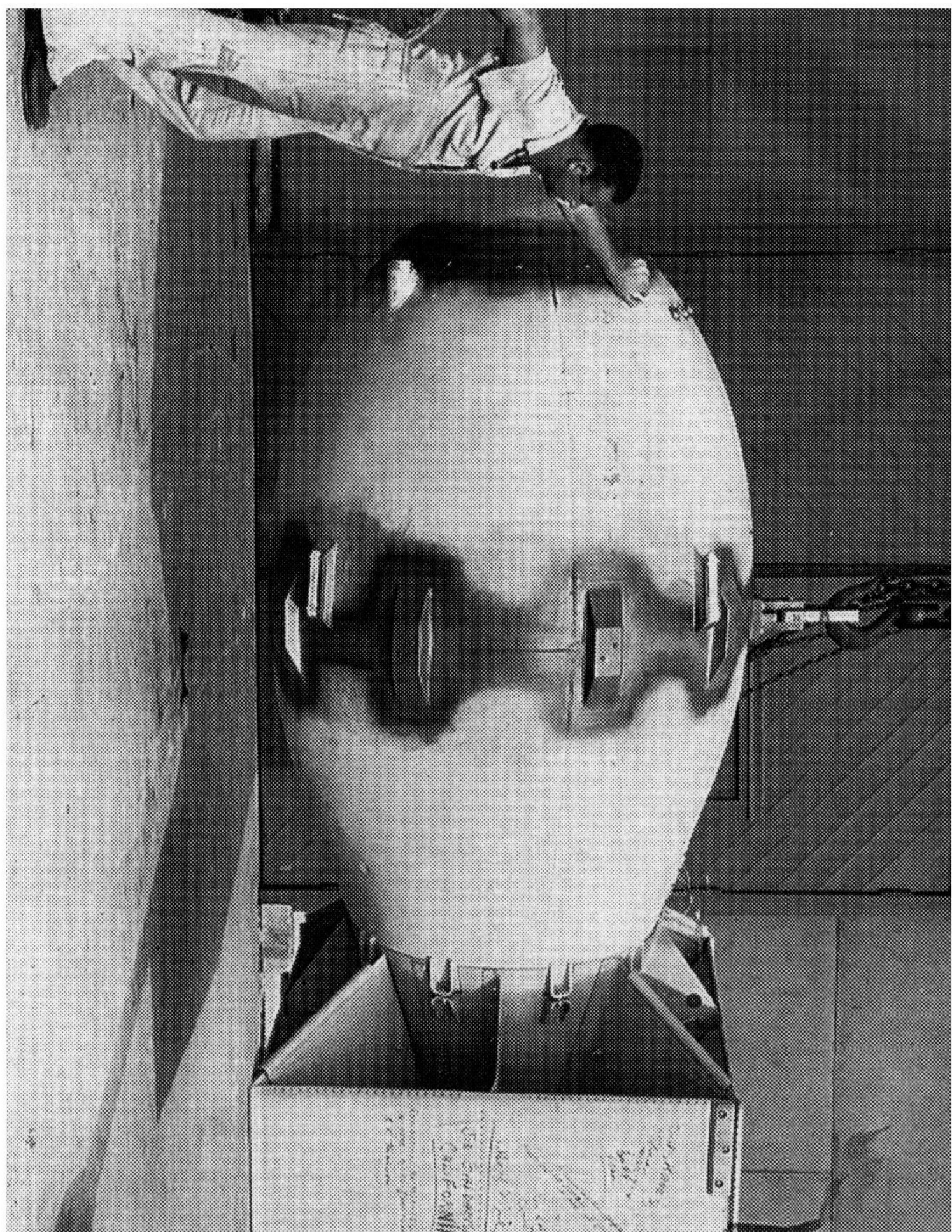
# 1ST RUSSIAN REACTOR LINE HANFORD



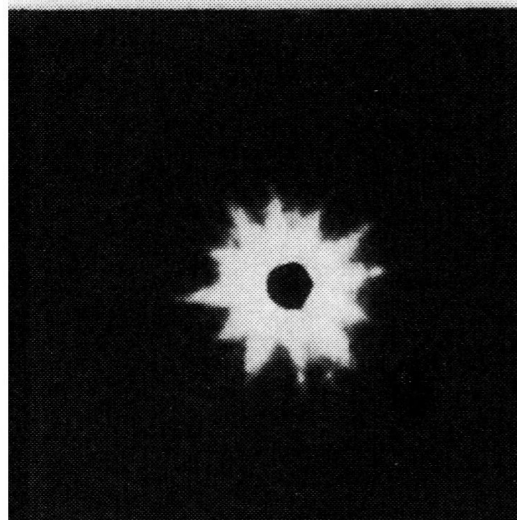
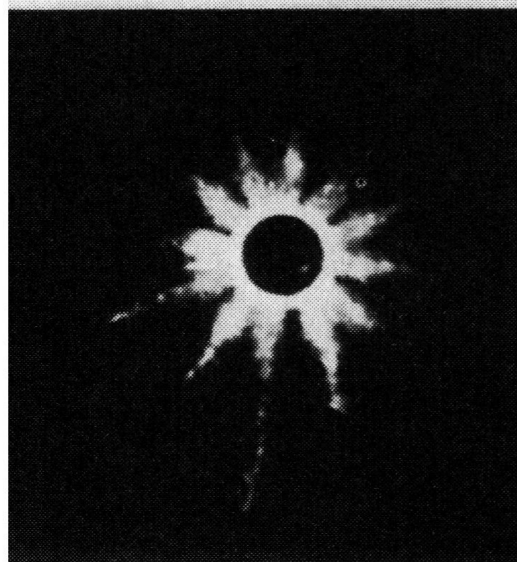
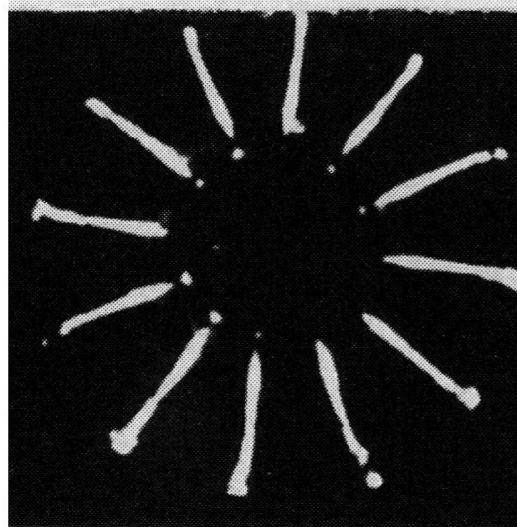
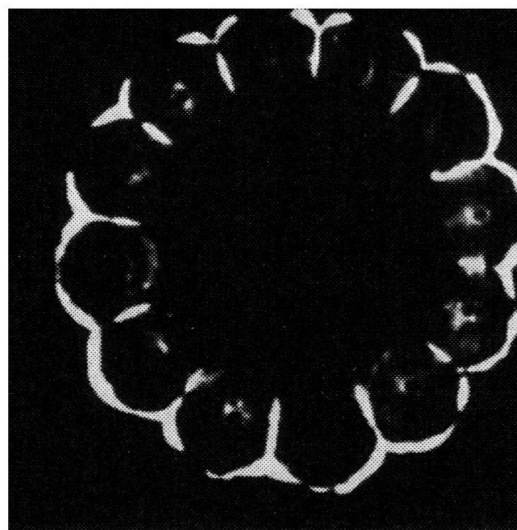














FEYNMAN BREAKING INTO LOS ALAMOS  
SAFE - NO REAL SECURITY!!



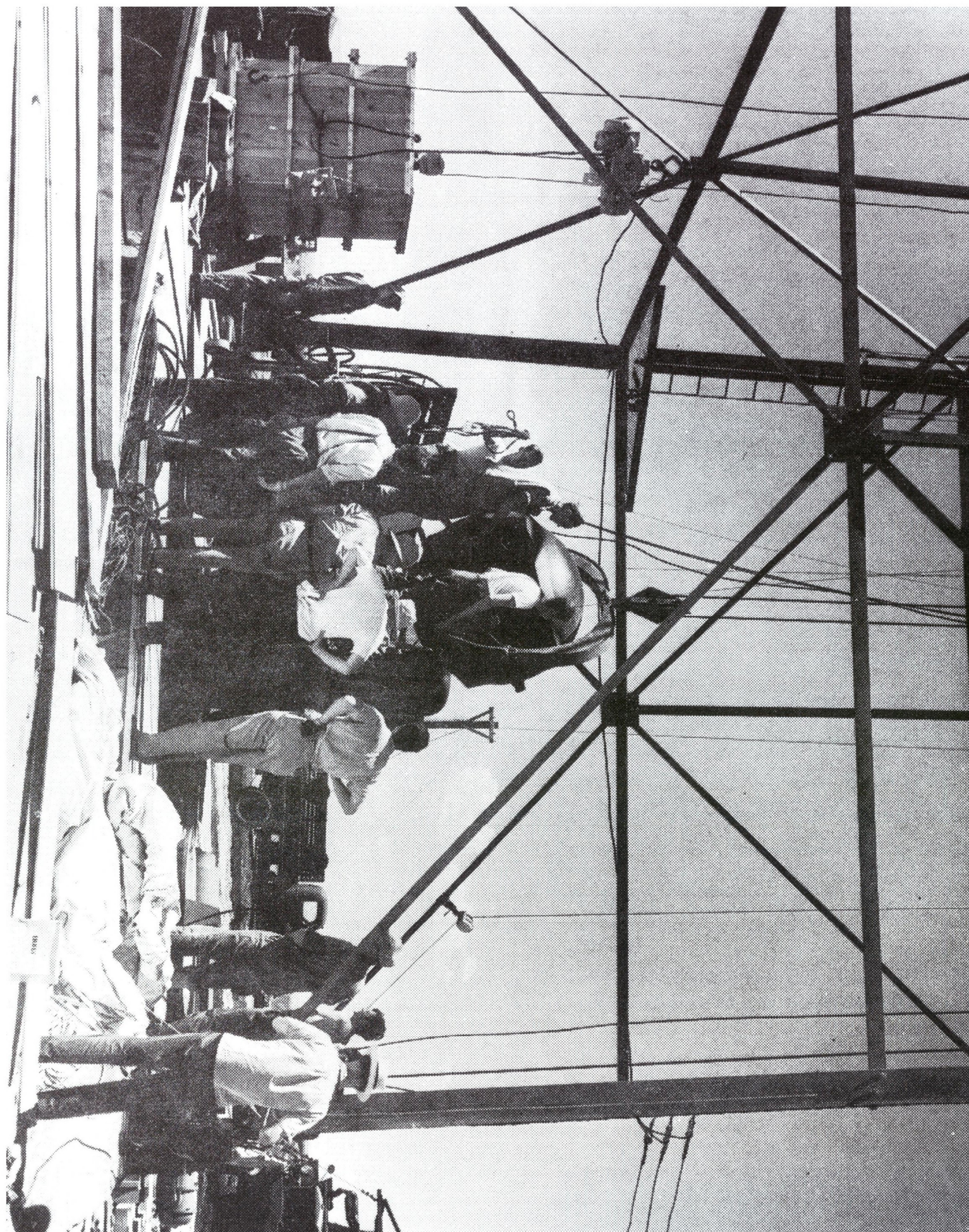
At Los Alamos: "I opened the safes which contained behind them the entire secret of the atomic bomb ..."



Los Oranp  
OBERMEYER  
↓  
FEYNMAN  
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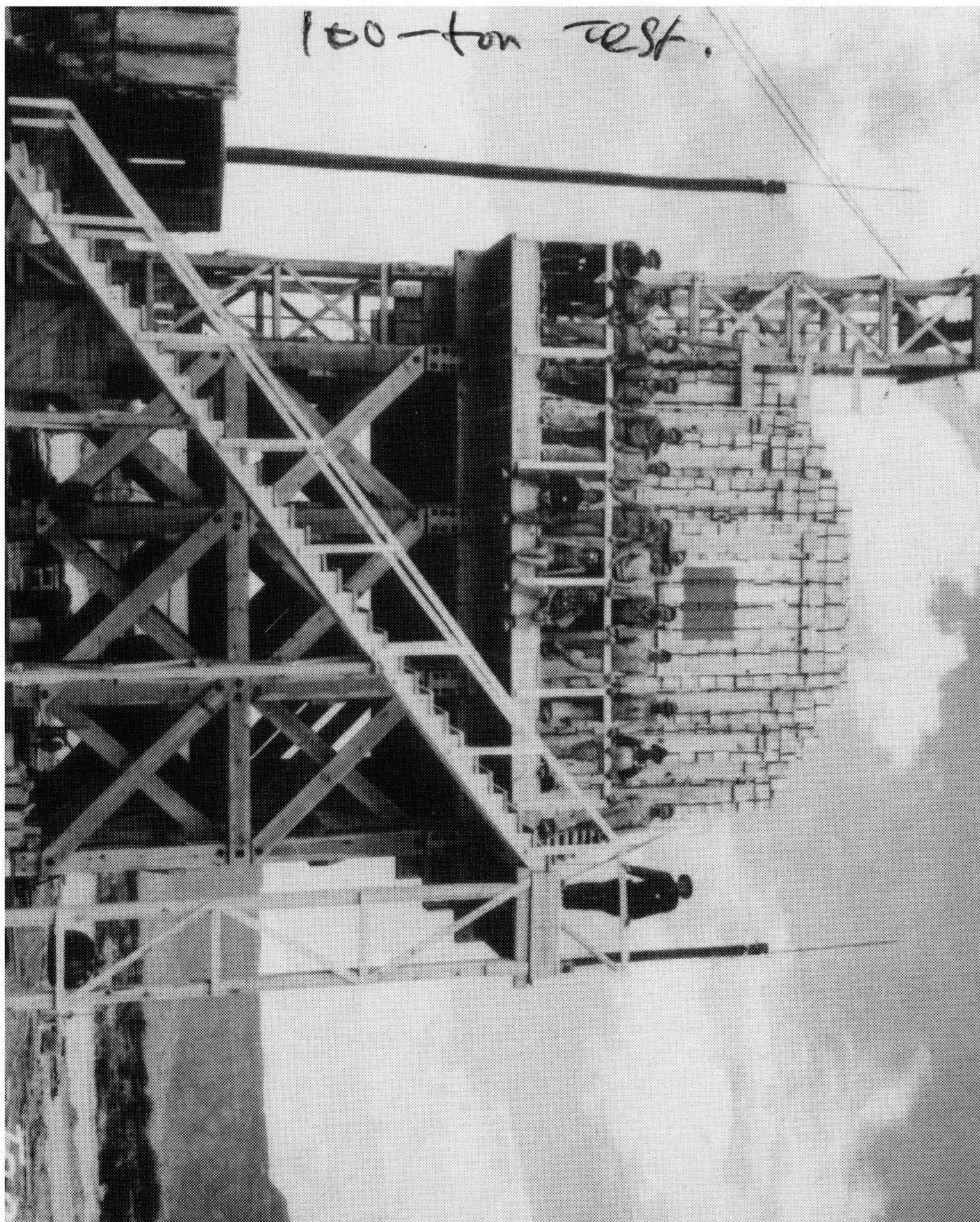








100-ton test.





# Los Alamos Atomic Bomb

## Atomic Bombing of Japan



By WILL HARRISON

Last week's "Big 1" handout from the Governor's office was today still reverberating in educational and legislative circles.

Governor Dempsey was quoted in the news handout as saying:

"During the 1943 Legislature I sponsored a bill which transferred all of the mineral leasing act funds to the school equalization fund. In 1944, in two years, that produced \$1,165,173 for the school equalization fund."

Today a letter from Sen. J. H. Mullis of Roswell:

"Before the 1943 Legislature I sponsored a bill which transferred all of the mineral leasing act funds to the school equalization fund. In 1944, in two years, that produced \$1,165,173 for the school equalization fund."

### Deadies Weapons in World's History Made in Santa Fe

Santa Fe learned officially today of a city of 6,000 in its own front yard.

The reverberating announcement of the Los Alamos bomb, the 2,000-ton inferno that blasted the great German city of Hiroshima, also lifted the secret of the community on the Pajarito Plateau, whose presence Santa Fe has ignored, except in whispers, for more than two years.

Decision to locate the Atomic Bomb Project Laboratory on mesa an hour's drive from Santa Fe, meant that it was necessary for the Army Engineers to construct an entirely new town to house the workers and their families. Primary reason for selection of the isolated site was security.

Ranch School Site  
When the Army took over the property early in 1943 there were a few buildings which had been occupied by the Los Alamos Ranch School. New buildings began going up at once. Today there are 37 in the mesa, which is almost level. 200 others on the property used for the project itself. Three hundred buildings containing 600 family units, also were constructed, as well as military barracks, hospital buildings and structures for administrative offices.

Dr. J. R. Oppenheimer, one of the foremost physicists in the country today, is in charge of the project.

News of the development at Los Alamos of an atomic bomb immediately raised questions regarding the potential industrial use of the atomic energy.

The power of the atomic force harnessed by scientists in the secret project is a almost beyond comprehension—one bomb packed the wallop of the bomb loads of 2,000 Superforts. Talk was at once heard of the possibility of the newly controlled energy replacing coal as a power source, water as a source of power.

That the study of the subject was assured by the appointment by the Secretary of War of a committee to carry on investigation of atomic energy.

Spokesman for the Los Alamos project said it had not been in the minds of the project to use atomic energy for the production of electricity.

Scientific groups which had been working on the project elsewhere in the country moved in rapidly, bringing their equipment with them. The Harvard cyclotron was in operation within a few days of its arrival. The cyclotron had reached the site.

Today the community has more than 10,000 people living there. Two-thirds are civilians, women and children and the remainder are military personnel. The commandant is Col. Gerald R. Tyler. First need of arriving personnel was housing. Various types of quarters were constructed to meet different needs. There are three-room prefabricated, individual houses, three-room apartments, eight to a building, and four- and five-room apartments, four in a row, in a row. There are some huts and Quonset-type huts and government and personally-owned trailers.

Personnel living in dormitories at Santa Fe is also a dining room with water and electricity. City Dads, too.

A "town council" of eight elected members met last night to discuss the project and the needs of the community. The council is composed of representatives of the project and the community. The council is composed of representatives of the project and the community.

His Johnson Dies at 79

WASHINGTON, Aug. 6 (AP)—Benjamin W. Johnson, 79, died at his home in Washington, D. C., today.

The veteran Republican senator, who had been confined for 3 1/2 weeks by a cerebral artery, died at 6:45 a. m. after having been in ill health for some time.

His political activities extended over a third of a century covering some of the most stirring events in the nation's history.

A striking figure in the Senate since first elected to Congress in 1904, Johnson was a leader in the fight for the National Labor Relations Act, the National Industrial Recovery Act, and the Social Security Act.



TERRITORIAL CHANGES OF WORLD WAR II—Black areas on map are those of Germany which the Big Three proposed to share today as 190 Superforts and Mustang fighters reportedly swept the enemy's sacred islands with fire bombs, rockets and parachuted mines.

### 4 More Nippon Cities Now Smoldering Ruins

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

By the Associated Press

### 'Utter Destruction,' Promised in Potsdam Ultimatum, Unleashed; Power Equals 2,000 Superforts

WASHINGTON, Aug. 6 (AP)—The U. S. Army Air Force has released on the Japanese an atomic bomb containing more power than 20,000 tons of TNT.

It produces more than 2,000 times the blast of the largest bomb ever used before.

The announcement of the development was made in a statement by President Truman released by the White House today.

The bomb was dropped 16 hours ago on Hiroshima, an important Japanese army base.

The President said that the bomb has "added a new and revolutionary increase in destruction" on the Japanese.

Mr. Truman added:

"It is an atomic bomb. It is a harnessing of the basic power of the universe. The force from which the sun draws its power has been loosed against those who brought war to the United States and to the Japanese. The unleashed power it has given us must be placed under the control of men."

The war effort but failed. Meanwhile American and British scientists studied the problem and developed two principal plants and some lesser factories for the production of atomic power.

The President disclosed that more

WILL SHORTEWAVE  
WASHINGTON, Aug. 6 (AP)—Secretary Wilson predicted today that the atomic bomb will "prove a tremendous aid" in shortening the war.

The war secretary made his statement as the Army reported that "insuperable cloud of dust and smoke" cloaked Hiroshima after it was hit by the new weapon from the air.

An accurate assessment of the damage inflicted by the bomb is not yet available, however, the War Department said. As soon as details of its effectiveness are known, the department added, they will be released.

WASHINGTON, Aug. 6 (AP)—The atomic bomb disclosed by President Truman today was developed at factories in Tennessee, Washington and New Mexico.

Mr. Truman said that from 65,000 to 125,000 workers were employed on the project at Oak Ridge near Knoxville, Tenn., at Richland near Pasco, Wash., and at an installation near Santa Fe, N. M.

He said the work was so secret that the employees did not know the character of it.

Previously, although the 20th Air Force on Guam announced that 580 Superforts raided four Japanese cities at about 10,000 feet, the city of 318,000 also contains a principal port.

8 Billion Gambit  
The President disclosed that the Germans "worked feverishly" in search of a way to use atomic energy.

### Tomato Juice Off Rationing

WASHINGTON, Aug. 6 (AP)—Grocers scratched point values today from canned tomato juice, mixed vegetable juice and grapefruit-orange juice blends.

OFA's action in making those products ration-free yesterday followed a recommendation from Secretary of Agriculture Anderson based on a report from a working party.

Anderson also announced that civilian store shelves will get 10,000,000 cans of tomato juice, mixed vegetable juice and grapefruit-orange juice blends.

WASHINGTON, Aug. 6 (AP)—The atomic bomb, announced by President Truman today packs a punch of 20,000 tons of TNT, a normal delivery by 2,000 B-29s.

The President said the missile has an explosive force equal to 20,000 tons of TNT, a normal delivery by 2,000 B-29s.

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### Now They Can Be Told Aloud, Those Stories of 'the Hill'

By WILLIAM MCNULTY

The secret of Los Alamos is out and the New Mexican staff is out. The Los Alamos Atomic Bomb Project, the institution which preceded the Los Alamos Atomic Bomb Project Laboratory, ceased to be a secret. The Los Alamos Atomic Bomb Project, the institution which preceded the Los Alamos Atomic Bomb Project Laboratory, ceased to be a secret.

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# ATOMIC BOMBS DRO



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The act, in two years, has produced \$1,165,173 for the school equalization fund.

Comes today a letter from Sen. J. H. Mullis of Roswell:

"Before the 1943 Legislature I conferred with J. D. Shinkle, superintendent of the Roswell schools, Col. E. L. Lusk of the New Mexico Military Institute, and Clarence E. Hinkle, president of the Roswell board of education, regarding legislation which would increase the teachers' salaries. We decided on three bills:

"1.—To transfer to the school fund, to be used to increase the teachers' salaries, the balance of the Mineral Leasing Act fund, mentioned by Governor Dempsey;

"2.—Reducing from 5 per cent to 3 per cent the amount allowed the Bureau of Revenue for collecting the sales tax;

"3.—Limiting the Commissioner of Public Lands to \$100,000 per year.

"I had these bills prepared before the Legislature convened and Governor Dempsey had nothing to do with the preparation of these bills. It is my recollection that Governor Dempsey was opposed to the mineral funds bill because it took that amount from the general fund.

"I introduced the bills and with the help of the New Mexico Educational Association secured the passage of the first but the Governor had the other two killed."

As noted in this space Saturday, the teachers act which the Governor said "I sponsored" was permitted to pass only after the school lobby consented to support a Dempsey measure permitting the transfer of certain surplus administrative funds to the state general fund.

And after the "I sponsored bill" became law the administration even then tried to grab part of the mineral leasing money for other than school support. Nov. 20, 1943, state records show, Governor Dempsey's State Board of Finance ordered \$85,612.16 of mineral leasing money transferred to the general fund. Educational groups put up a fight and on Nov. 29, 1943, the amount was returned on the authority of an Attorney General's opinion.

Although the schools received during the past two years \$1,165,173 as a result of the "I sponsored bill" a complete and truthful statement would show that funds almost equaling that amount were taken from the schools by Dempsey sponsored bills in the same Legislature that enacted the mineral leasing funds law.

The transfer law, for which Demp-

## Deadliest Weapons in World's History Made In Santa Fe Vicinity

Santa Fe learned officially today of a city of 6,000 in its own front yard.

The reverberating announcement of the Los Alamos bomb, with 2,000 times the power of the great Grand-Slammers dropped on Germany, also lifted the secret of the community on the Pajarito Plateau, whose presence Santa Fe has ignored, except in whispers, for more than two years.

Decision to locate the Atomic Bomb Project Laboratory on mesa an hour's drive from Santa Fe, meant that it was necessary for the Army Engineers to construct an entirely new town to house the workers and their families. Primary reason for selection of the isolated site was security.

### Ranch School Site

When the Army took over the property early in 1943 there were a few buildings which had been occupied by the Los Alamos Ranch School. New buildings began going up at once. Today there are 37 in the main technical area and about 200 others on the property used for the project itself. Three hundred buildings containing 620 family units, also were constructed, as well as military barracks, hospital buildings and structures for administrative offices.

Dr. J. R. Oppenheimer, one of the foremost physicists in the coun-

ty, in mess halls, or in a large cafeteria, was housing. Various types were constructed, to meet different needs. There are three-room prefabricated, individual houses; three-room apartments, eight to a building, and four- and five-room apartments, four in a two-story unit. There are some huts, Quonset-type huts and government and personally-owned trailers.

### Bachelor Dorms

Dormitories have been constructed for unmarried personnel, or persons who do not have their families with them. Rents, for family groups, are based on earnings. Apartments are unfurnished and family groups ordinarily bring their furniture with them, although some items of government furniture have been available.

Housewives shop for food for daily meals at an army commissary where ration points are as important as elsewhere. A "trading post" offers items needed in everyday life and there are the usual post exchange stores.

Personnel living in dormitories eat there is also a dining room with waitress service.

### City Dads, Too

A "town council" of eight elected members serves in an advisory capacity, meeting with representatives of the project and of the commanding officer. There is a school board, appointed by Colonel Tyler and Doctor Oppenheimer, which oversees operation of an accredited elementary school and high school. There

(Continued on Back Page)

### REVOLUTIONARY

News of the development at Los Alamos of an atomic bomb immediately raised conjecture regarding the potential industrial uses of the energy.

The power of the atomic force harnessed by scientists in the secret projects is almost beyond comprehension—one bomb packing the wallop of the bomb loads of 2,000 Superforts. Talk was at once heard of the possibility of the newly controlled energy replacing coal, electricity, gasoline, water as a source of power.

That the study of the subject will continue was assured by the appointment by the Secretary of War of a committee to carry on investigation of atomic energy.

Spokesmen for the Los Alamos project said they had not been informed if this meant post-war continuation of the mountain project.

try and director of the laboratory, came to the site during early stages of construction. Other scientists and technical workers followed soon after.

Scientific groups which had been working on the project elsewhere in the country moved in rapidly, bringing their equipment with them. The Harvard cyclotron was in operation six weeks after it had reached the site.

### Tortuous Route

Nearest railroad facilities are at Albuquerque and Santa Fe. This made it necessary to truck everything from those cities, at least. The road from Santa Fe is a tortuous one, and in the beginning, the last 18 miles were not paved. This was bad enough for passenger cars, and presented a particularly tough problem in hauling heavy loads.

Today the community has more than 6,000 residents. Slightly less than two-thirds are civilian men, women and children and the remainder military personnel. The post commandant is Col. Gerald R. Tyler,



**TERRITORIAL CHANGES OF WORLD WAR II**—Black areas on map are those parts of Germany which the Big Three propose will come under Polish rule. Shaded area is territory which Russia has taken control over since the start of hostilities on the continent. Northern East Prussia, proposed as Russian by the Big Three, is the newest addition to Soviet territory. There still remains some question as to final disposition of the port of Stettin. Note the large section of Baltic coastline of the proposed new Poland.

## 4 More Nippon Cities Now Smoldering Ruins

By The Associated Press

American airmen said they turned four more forewarned Japan cities to ashes today as 750 Superforts and Mustang fighters reported swept the enemy's sacred islands with fire bombs, rockets and parachute mines.

B-29 crewmen returning to their Marianas Island bases told of settlements visible for 150 miles at sea. Some ran into intense antiaircraft and strong interception including rocket planes as they raided the Tokyo described as "defenseless."

Waves of B-29s from the Marianas Islands and Mustang fighters from Iwo Jima struck as American commanders announced 70 Nipponese ships and small craft and 61 locomotives were destroyed or damaged in previous aerial blows, reaching over 4,500 miles from Paramushiro to Singapore.

Terror-ridden China carried the brunt of ground actions. Elsewhere

land armies hunted for Japanese generals in the northern Philippines, drove toward trapping the largest Japanese force remaining in New Guinea and counted 13,000 Nipponese dead in recent fighting in monsoon-swept south Burma.

Superforts warned 12 more cities Sunday morning they were on their fire list. A formation of 580 followed up today by lightning towering fires in four of the 31 forewarned cities.

Today's targets include Nishinomiya, noted in prewar days for producing Japan's best sake, favorite alcoholic beverage of Nippon. The other industrial targets were Maebashi, 60 miles from Tokyo, saga on northern Honshu Island, and Imburi, on the southern island of Honshu. One B-29 unit hammered the Ube coal liquefaction plant with high explosives.

Japanese also reported Mustangs from Iwo raked the capital with

lets in daylight for the third time in four days.

For consolation, Japanese propagandists reported: "Americans 'led a starvation life.' Nipponese raid caught U. S. planes lined up to wing on two Okinawa airfields. A U. S. submarine was sunk off coast of Japan; Nipponese subs and two Allied vessels in the central Pacific.

Chinese reports told of new tests in China. Once-beautiful Kwei former southeast China air base was left thoroughly sacked. Fifteen thousand Chinese were killed missing from Kanhshien in east central China. A thousand civilians were reported killed by forced poisonous injections at Ichang, near the central China river port.

Americans and Filipinos eliminated an ambushing Japanese company and beat back two desperate counterattacks on northern Luzon island, running last week's toll the Philippines to 4,740 Japan killed and 444 taken prisoner. U. S. losses for the week were 27 killed wounded.

Maj. Gen. William Gill offered 45-day furlough to any member the 32d Division who captures enemy general alive. Chief prize Gen. Tomoyuki Yamashita, once "Tiger of Malaya" variously reported cornered, killed or flown f

## Hi Johnson Dies at 79

WASHINGTON, Aug. 6 (AP)—Sen. Hiram W. Johnson of California, militant opponent of the League of Nations and the San Francisco Charter for a United Nations organization, died today.

The veteran Republican senator succumbed at Naval Hospital, where he had been confined for 2½ weeks. His physician, Capt. Robert E. Duncan, U.S.N., said he died from a thrombosis of a cerebral artery.

The 79-year-old Californian died at 6:45 a. m., after having been in ill health for some time.

His political activities extended over a third of a century covering some of the most stirring events in the nation's history.

A striking figure in the Senate since first elected to Congress in 1916, he played a leading part in defeating President Wilson's League of Nations Covenant and later in opposing United States' adherence to the World Court.

His wife, whom he referred to as "the boss," was with him at the time of his death.

Senator McKellar (D-Tenn.), President of the Senate, today will appoint a committee to attend the



# 'Utter Destruction,' Promised in Potsdam Ultimatum, Unleashed; Power Equals 2,000 Superforts

WASHINGTON, Aug. 6 (AP)—The U. S. Army Air Force has released on the Japanese an atomic bomb containing more power than 20,000 tons of TNT.

It produces more than 2,000 times the blast of the largest bomb ever used before.

The announcement of the development was made in a statement by President Truman released by the White House today.

The bomb was dropped 16 hours ago on Hiroshima, an important Japanese army base.

The President said that the bomb has "added a new and revolutionary increase in destruction" on the Japanese.

Mr. Truman added:

"It is an atomic bomb. It is a harnessing of the basic power of the universe. The force from which the sun draws its power has been loosed against those who brought war to the Far East."

The base that was hit is a major quartermaster depot and has large ordnance, machine tool and aircraft plants.

The raid on Hiroshima, located on Honshu Island on the shores of the Inland sea, had not been disclosed

in their war effort but failed. Meantime American and British scientists studied the problem and developed two principal plants and some lesser factories for the production of atomic power.

The President disclosed that more

## WILL SHORTEN WAR

WASHINGTON, Aug. 6 (AP) — Secretary Stimson predicted today that the atomic bomb will "prove a tremendous aid" in shortening the war with Japan.

The war secretary made his statement as the Army reported that an "impenetrable cloud of dust and smoke" cloaked Hiroshima after it was hit by the new weapon from the air.

An accurate assessment of the damage inflicted by the bomb is not yet available, however, the War Department said. As soon as details of its effectiveness are learned, the department added, they will be released.

than 65,000 persons now are working in great secrecy in these plants, adding:

"We have spent \$2,000,000,000 on the greatest scientific gamble in history — and won."

"We are now prepared to obliterate more rapidly and completely every productive enterprise the Japanese have above ground in any city. We shall completely destroy Japan's power to make war."

The President noted that the Big Three ultimatum issued July 26 at Potsdam was intended "to spare the Japanese people from utter destruction" and the Japanese leaders rejected it. The atomic bomb now is

## PUNCH CATASTROPHIC

WASHINGTON, Aug. 6 (AP) — The atomic bomb announced by President Truman today packs a punch equivalent to that normally delivered by 2,000 B-29s.

The President said the missile has an explosive force equal to 20,000 tons—40,000,000 pounds—of TNT. Assuming a B-29 carries a bomb load of 10 tons of TNT, four 500-plane raids by the world's biggest bombers would be necessary to equal in destructive power the exploding fury of one atomic bomb.

The atomic bomb dwarfs by 2,000 times the blast power of the British "grand-slam" bomb which

## May Be Tool To End Wars; New Era Seen

Mankind's successful transition to a new age, the Atomic Age, was ushered in July 16, 1945, before the eyes of a tense group of renowned scientists and military men gathered in the desertlands of New Mexico to witness the first hand results of the \$2,000,000,000 effort. Here in a remote section of the Alamogordo Air Base 120 miles southeast of Albuquerque the first man-made atomic explosion, the outstanding achievement of nuclear science, was achieved at 5:30 a. m. of that day.

Mounted on a steel tower, a revolutionary weapon destined to change war as it has been known, or which may even be the instrumentality to end all wars, was set off with an impact which signalized man's entrance into a new physical world. Success was greater than the most ambitious estimates. A small amount of matter, the product of a chain of huge specially constructed industrial plants, was made to release the energy of the universe locked up within the atom from the beginning of time.

## Credit J. R. Oppenheimer

This phase of the Atomic Bomb Project, which is headed by Major Gen. Leslie R. Groves, was under the direction of Dr. J. R. Oppenheimer, theoretical physicist of the University of California. He is to be credited with achieving the implementation of atomic energy for military purposes.

Tension before the actual detonation was at a tremendous pitch. Failure was an ever-present possibility. Too great a success, envisioned by some of those present might have meant an uncontrollable unusable weapon.

Final assembly of the atomic bomb began on the night of July 12 in an old ranch house. As various component assemblies arrived from distant points, tension among the scientists rose to an increasing pitch. Coolest of all was the man charged with the actual assembly of the vital core, Dr. R. F. Bacher, in normal times a professor at Cornell University.

## Lightning Threatens

On Saturday, July 14, the uncertainty which was to determine the success or failure of the entire project was elevated to the top of the steel tower.

The ominous weather which had dogged the assembly of the bomb had a very sobering effect on the assembled experts whose work was accomplished amid lightning flashes and peals of thunder.

Nearest observation point was set up 10,000 yards south of the tower where in a timber and earth shelter

## MADE IN SANTA FE

WASHINGTON, Aug. 6 (AP)—The atomic bomb disclosed by President Truman today was developed at factories in Tennessee, Washington and New Mexico.

Mr. Truman said that from 65,000 to 125,000 workers were employed on the project at Oak Ridge near Knoxville, Tenn., at Richland near Pasco, Wash., and at an unnamed installation near Santa Fe, New Mexico.

He said the work was so secret that most of the employees did not know the character of it.

previously although the 20th Air Force on Guam announced that 580 Superforts raided four Japanese cities at about the same time.

The city of 318,000 also contains a principal port.

## 2 Billion Gamble

The President disclosed that the Germans "worked feverishly" in search of a way to use atomic energy

## Tomato Juice Off Rationing

WASHINGTON, Aug. 6 (AP)—Grocers scratched point values today from canned tomato juice, mixed vegetable juice and grapefruit-orange juice blends.

OPA's action in making those products ration-free yesterday followed a recommendation from Secretary of Agriculture Anderson based on lowered military demands.

Anderson also announced that civilian store shelves will get 10,000,000 more cases of canned vegetables from this year's pack than had been expected.

Despite the 10 per cent increase, however, the Agriculture Department said the total still will be less than last year's.

## SENTENCED

Pat Chavez, 333 Urioste Street, faced a 100-day jail sentence and \$100 fine today on conviction before Peace Justice A. E. P. Robinson of assault and battery on a woman taxi driver. The court reported the case Saturday as involving a Pat Lopez and called attention today to the correct name of the defendant.



Nuclide	Reflector	Thickness (cm)	Critical mass (kg)
Uranium-235	None		49
Uranium-235	Beryllium	10	14
Uranium-235	Natural uranium	10	18
Plutonium-239	None		12.5
Plutonium-239	Beryllium	5.2	5.4
Plutonium-239	Beryllium	32	2.5
Plutonium-239	Natural uranium	5	6.4
Plutonium-239	Natural uranium	24	4.4



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*JR 0 #3*  
May 25, 1943

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Dr. Enrico Fermi  
Metallurgical Laboratory  
University of Chicago  
Chicago, Illinois

Dear Fermi:

I wanted to report to you on the question of the radioactively poisoned foods, both because there are some steps that I have taken, and because Edward Teller has told me of the difficulties into which you have run.

When I was in Washington I learned that the Chief of Staff had requested from Conant a summary report on the military uses of radioactive materials and that Conant was in the process of collecting the material for that report. I therefore, with Groves' knowledge and approval, discussed with him the application which seemed to us so promising, gave him a few points of detail and some orders of magnitude. I raised the question of what steps, offensive and defensive, should be taken in this connection. It is my opinion, and it was also Conant's, that the defensive measures would probably preclude our carrying out the method ourselves effectively, and therefore I asked that in his report the question of policy be raised as to which of these lines we should primarily follow. This report, and you will undoubtedly have heard of it in other connections, is to go directly to General Marshall so that it will have authoritative if not expert consideration. I hope to discuss the question further when Conant visits here in ten days.

I also plan to go into the matter a little more deeply with Hamilton, although of course only on the physiological side. As you know, he has already made studies of the strontium which appears to offer the highest promise, and he expressed his willingness to look into these questions more fully. I think that I can do this without in any way indicating the nature of our interest, but it will be some time, perhaps three weeks, before I get to see him.

I understand the difficulties that you have had in getting this subject developed without telling anyone about it, -

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and it is hard for me to give very sound advice on what to do. I think that there is at least one quite well defined radio-chemical problem, which is the separation of the beta-strontium from other activities. It is my impression after talking it over with Teller, that this is not a very major problem except in so far as provision would have to be made for carrying it out by remote control at the actual site of operations. I do not see how this can be done without letting a number of people into the secret of why we want the strontium. I should therefore like to ask you what you think the latest safe date is for the solution of this and other problems. It seems to me that we have a much better chance of keeping your plan quiet if we do not start work on it until it is essential to do so. If, in your opinion, the time for such work is now, I believe that you should discuss it with Allison and Franck and on their advice, if absolutely necessary, with Compton, and that perhaps this group of people will be enough to get the work done without more wide-spread discussion. In a general way I think we have better facilities here for keeping things of that kind within a well defined group, namely, the scientific personnel of the laboratory, than exists in other places. On the other hand, I do not think that we are equipped to tackle the problem with anything like the expedition that you can in Chicago.

//To summarize then, I should recommend delay if that is possible. (In this connection I think that we should not attempt a plan unless we can poison food sufficient to kill a half a million men, since there is no doubt that the actual number affected will, because of non-uniform distribution, be much smaller than this.) If you believe that such delay will be serious, I should recommend discussion with a few well-chosen people. Finally, I should postpone this action until I have had an opportunity to reopen the question with Conant and if possible to obtain information on the decision of the General Staff. //

Things here are going quite well and we are still remembering with pleasure and profit your fine visit. I hope that you can come again late in June, and that we shall have at that time some less programatic problems to discuss with you.

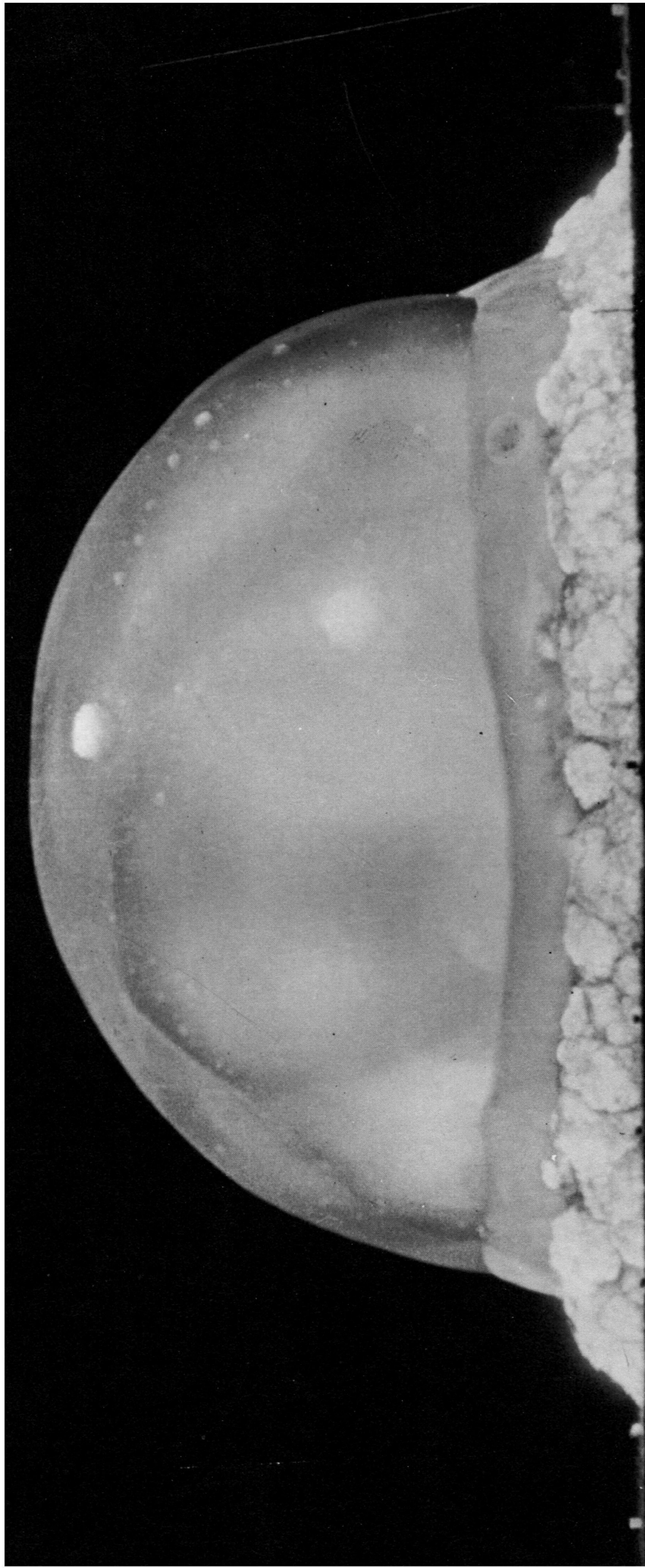
With all warm greetings,

*Robert Oppenheimer*

Robert Oppenheimer

CANCELLED

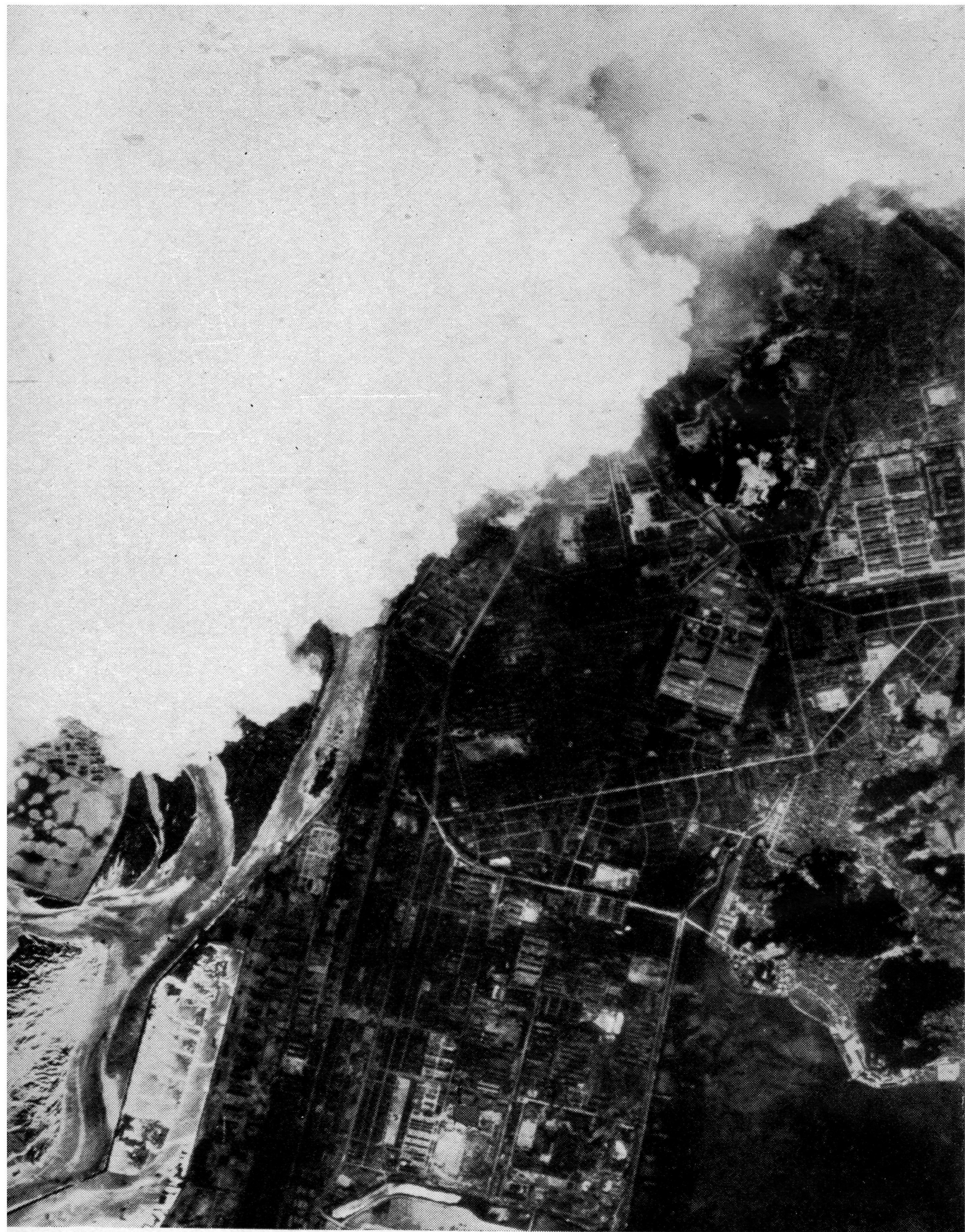




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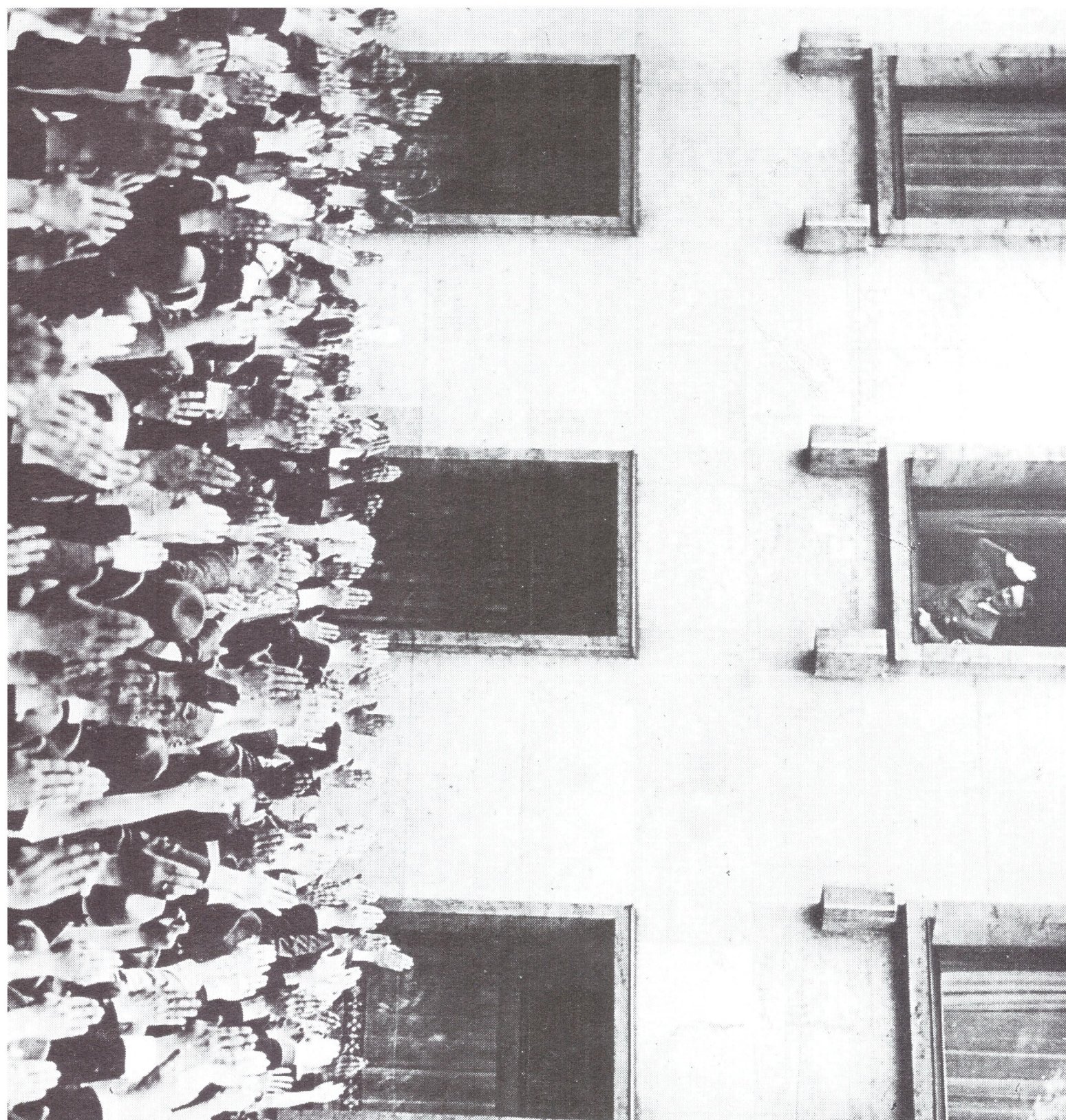




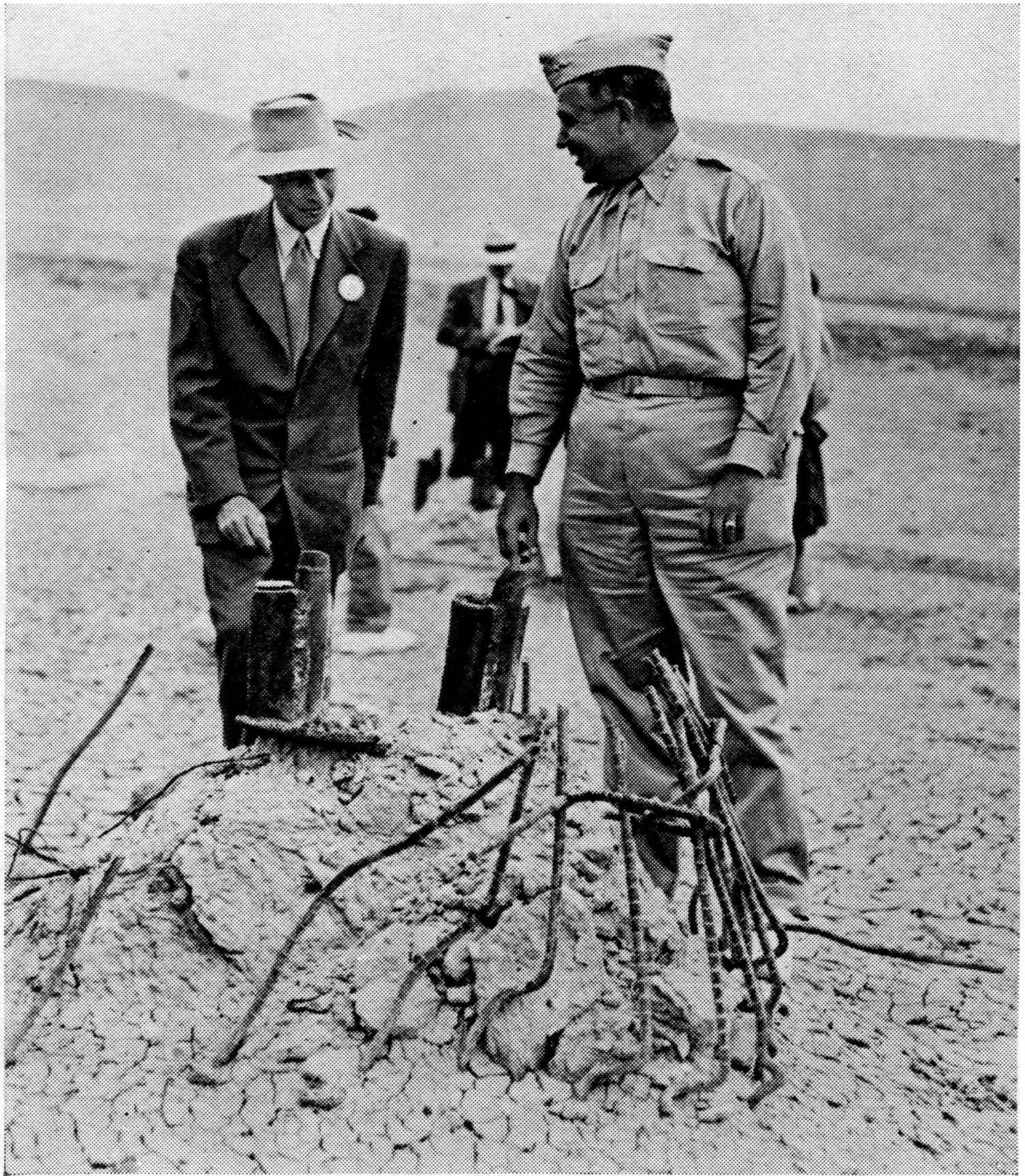
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*White smoke cloud rises from atomic bomb hit on Hiroshima*





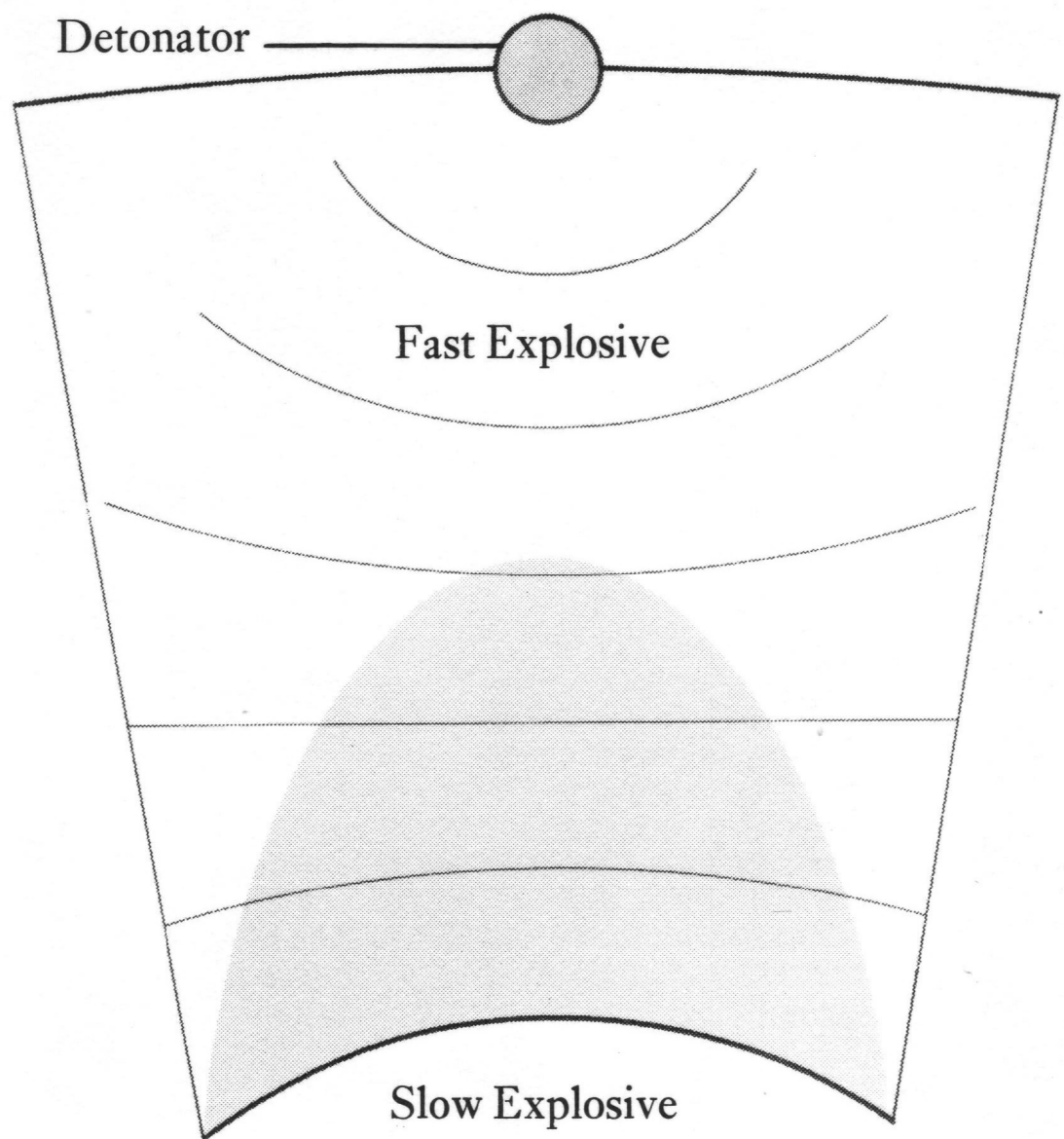
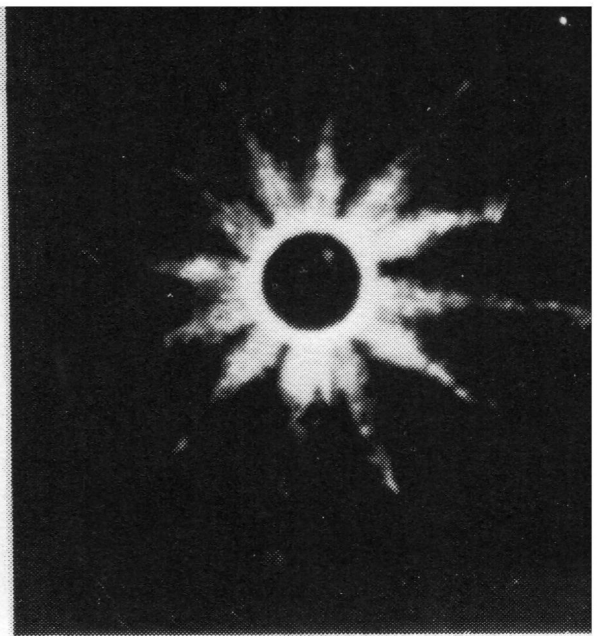
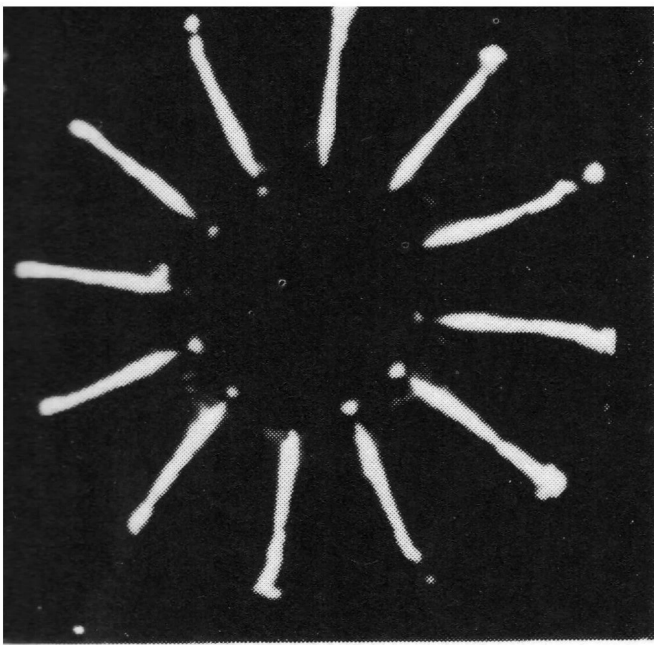




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Figure 1. *All that remained of the steel tower from which the test bomb was dropped in New Mexico; the rest of it disappeared into the air as vapor. Left, Dr. J. R. Oppenheimer; right, Major-General L. R. Groves.*



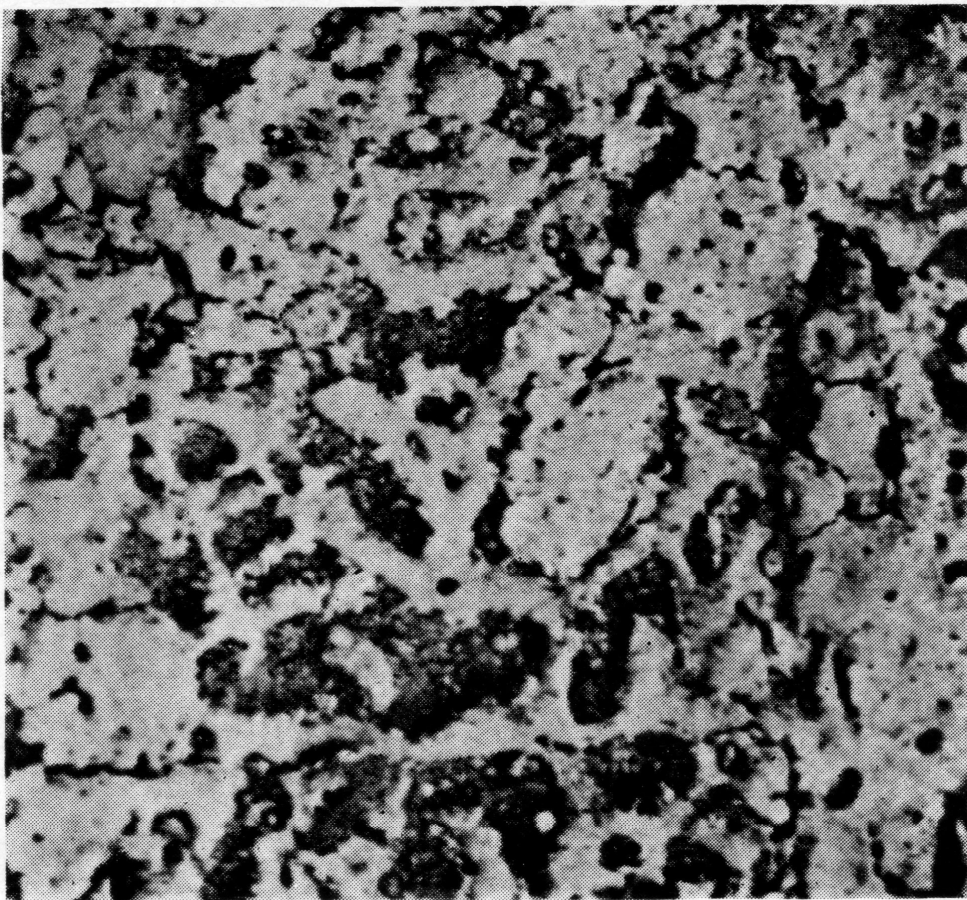
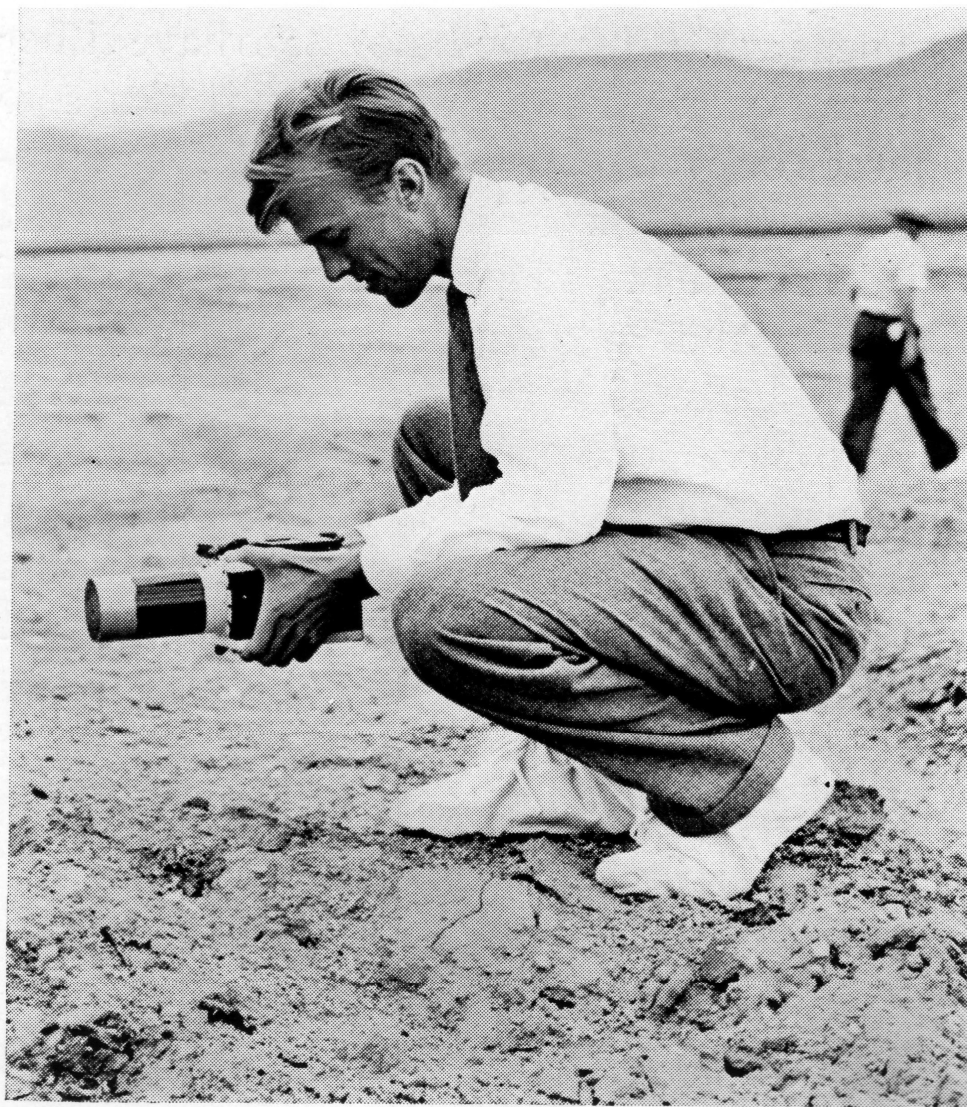


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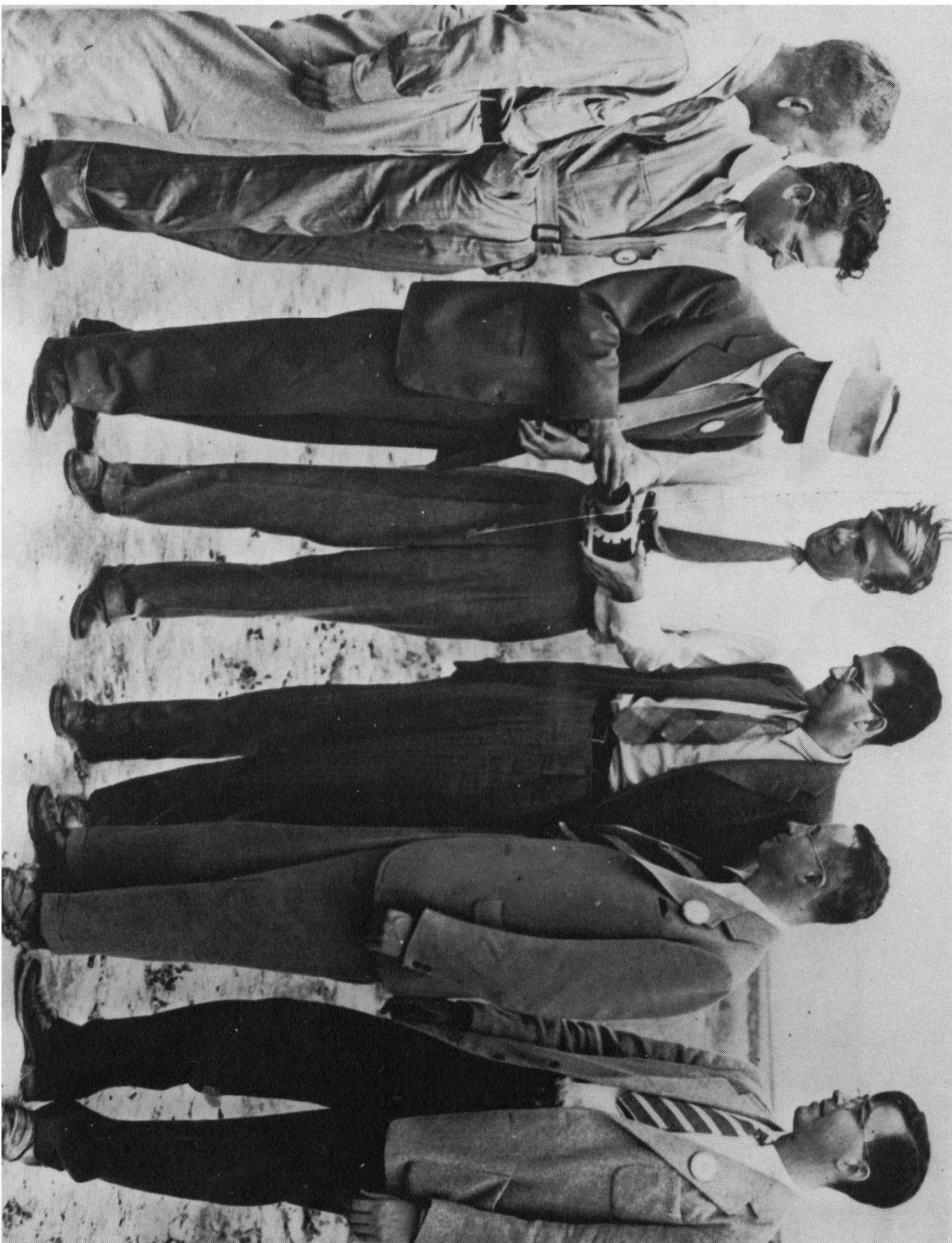


*Press Assoc., Inc.*

Figure 33. *Sand fused to glass-like structure where test bomb exploded in New Mexico.*



TRIMBY 11 SEPT. 145 Louis H. Hemmlemaun (Heur Physics)  
 CARTER: KRO ↓  
 AWEENS ↙ ↘ Robert Baile







*Press Assoc., In*

*Figure 6 The atom bomb attack on Hiroshima left the*